MARCH 1963 35 CENTS

Popular Science

Monthly

VEHICLE OF 500 USES

PSM SPOTLIGHT AWARD

p. 64

Amazing New Kind of Motor

Boats! Boats! Boats!

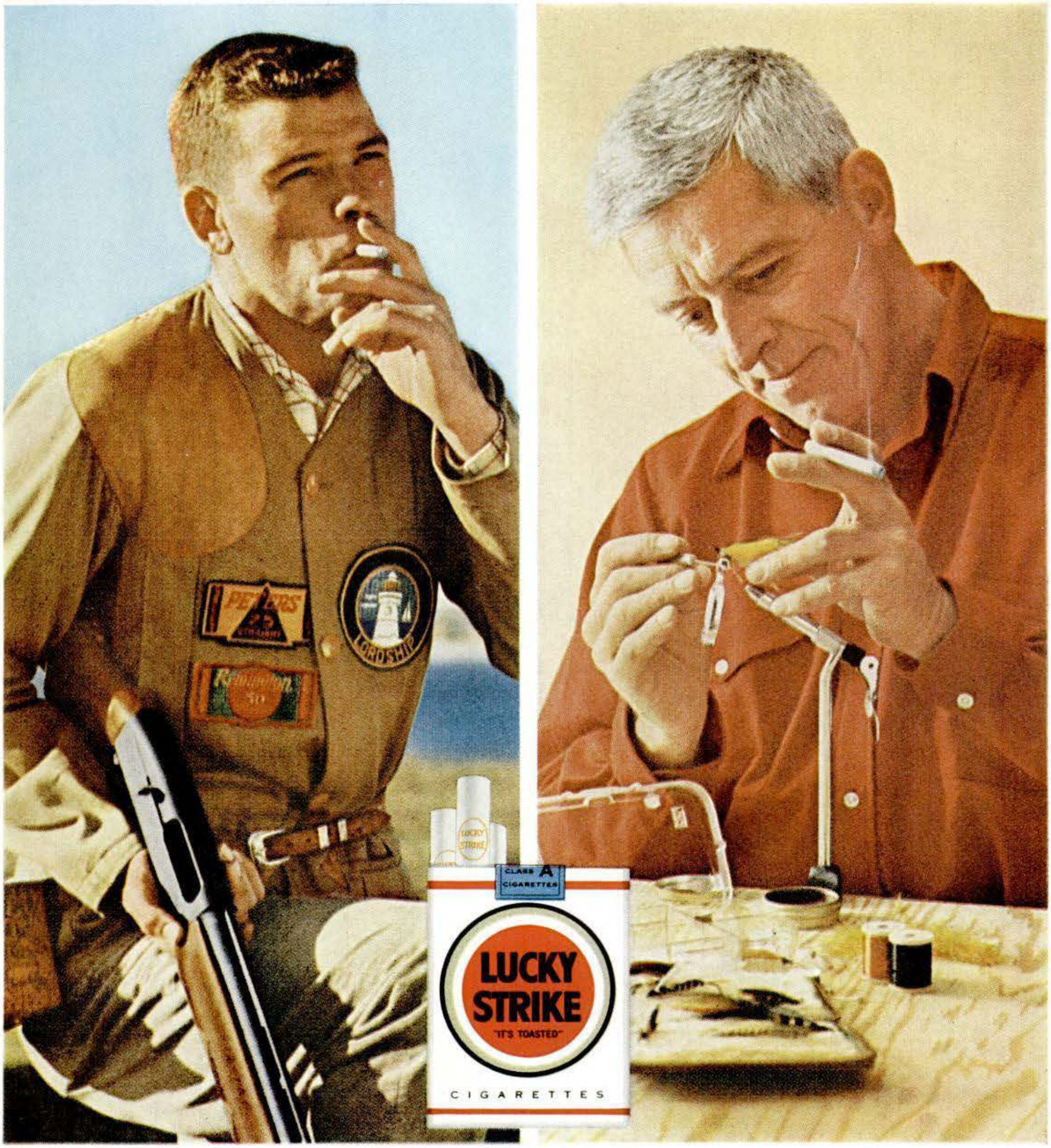
22 PAGES:

- How to get started in boating
- How to buy a used boat
- In color: How to outfit your new boat
- Specs on all outboard motors

Wernher von Braun Explains Nuclear Rockets

Get Lucky

the taste to start with...the taste to stay with



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Tempest's 4 makes you wonder why V-8s were ever invented...

...until you try Tempest's new V-8

Which do you want to have nestled quietly under the hood of your Tempest—the 4 that goes around acting like a V-8, or a new V-8 that acts like nothing you ever drove before. (It's optional at extra cost and 260 h.p. strong.) Decisions, decisions. If you were thinking that maybe you'd better drive them both before you make up your mind, that's fine with your Pontiac dealer. He knows these cars are habit-forming. **Wide-Track Pontiac Tempest**

Pontiac Motor Division • General Motors Corporation

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Founded in 1872
Vol. 182 No. 3

Popular Science

Mechanics and Handicraft ®
Popular Science ®
Monthly

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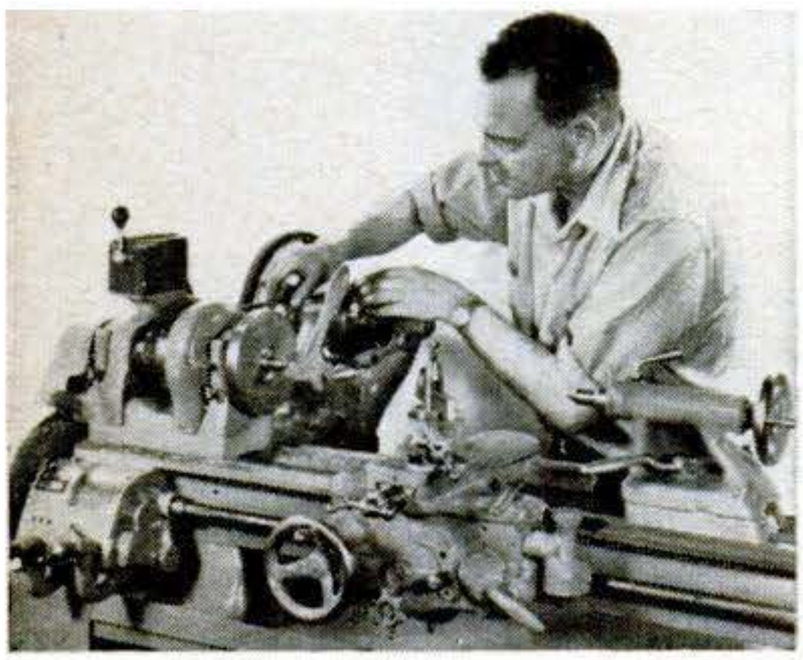
March 1963

Cover painting by Ray Pioch

The sea raged—and the Coast Guard ran out of rescue ships. Page 78.

PS announces the Spotlight Award—a new honor to be given in recognition of designs and products that contribute to man's material and cultural progress. First winner: Ford Econoline. Page 64.



This "tool of tools" separates the machinists from the boys. Page 106.

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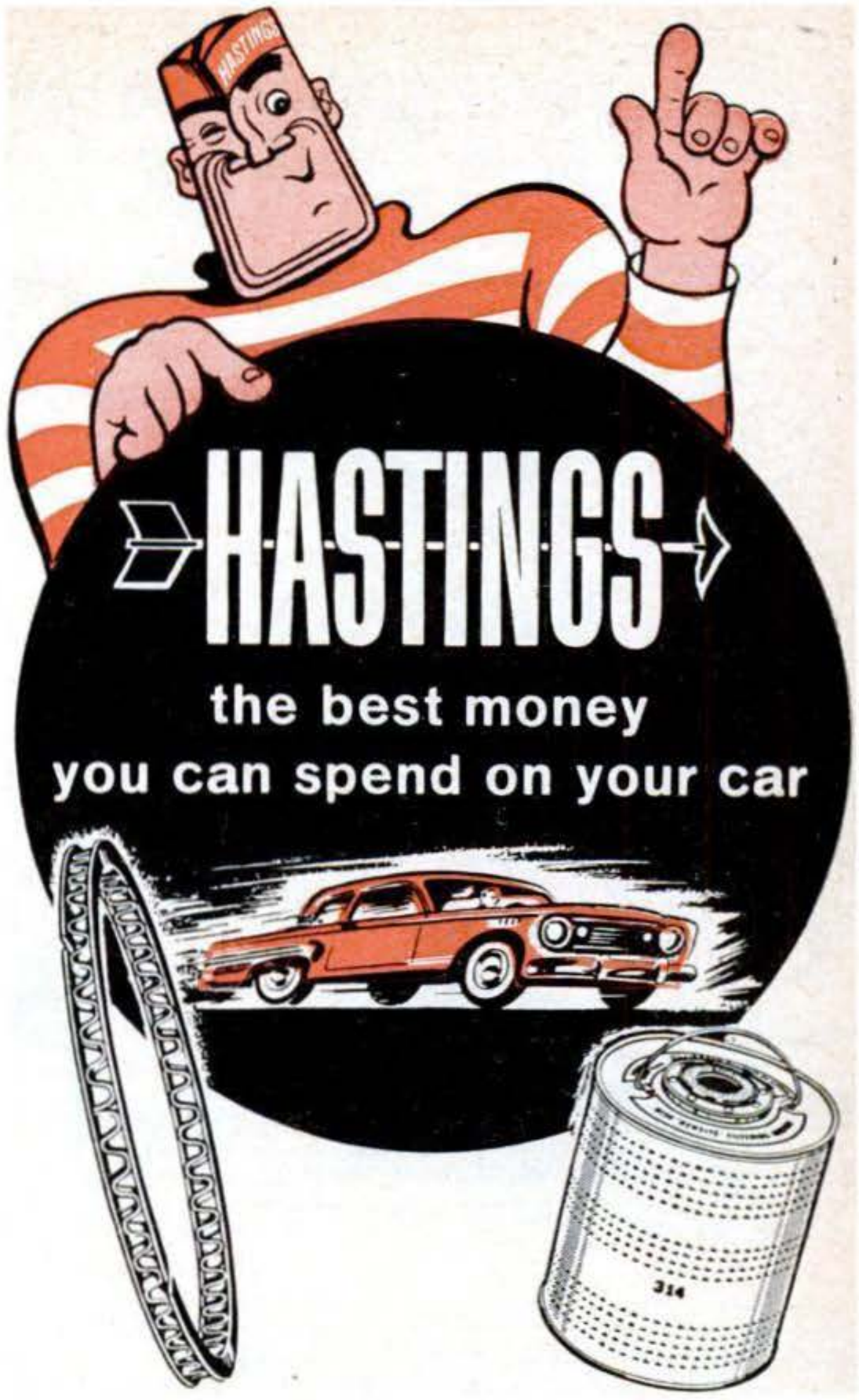

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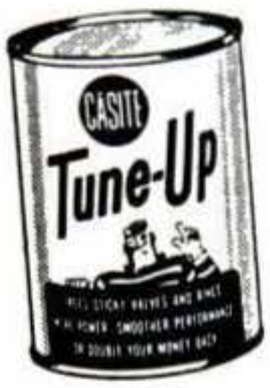

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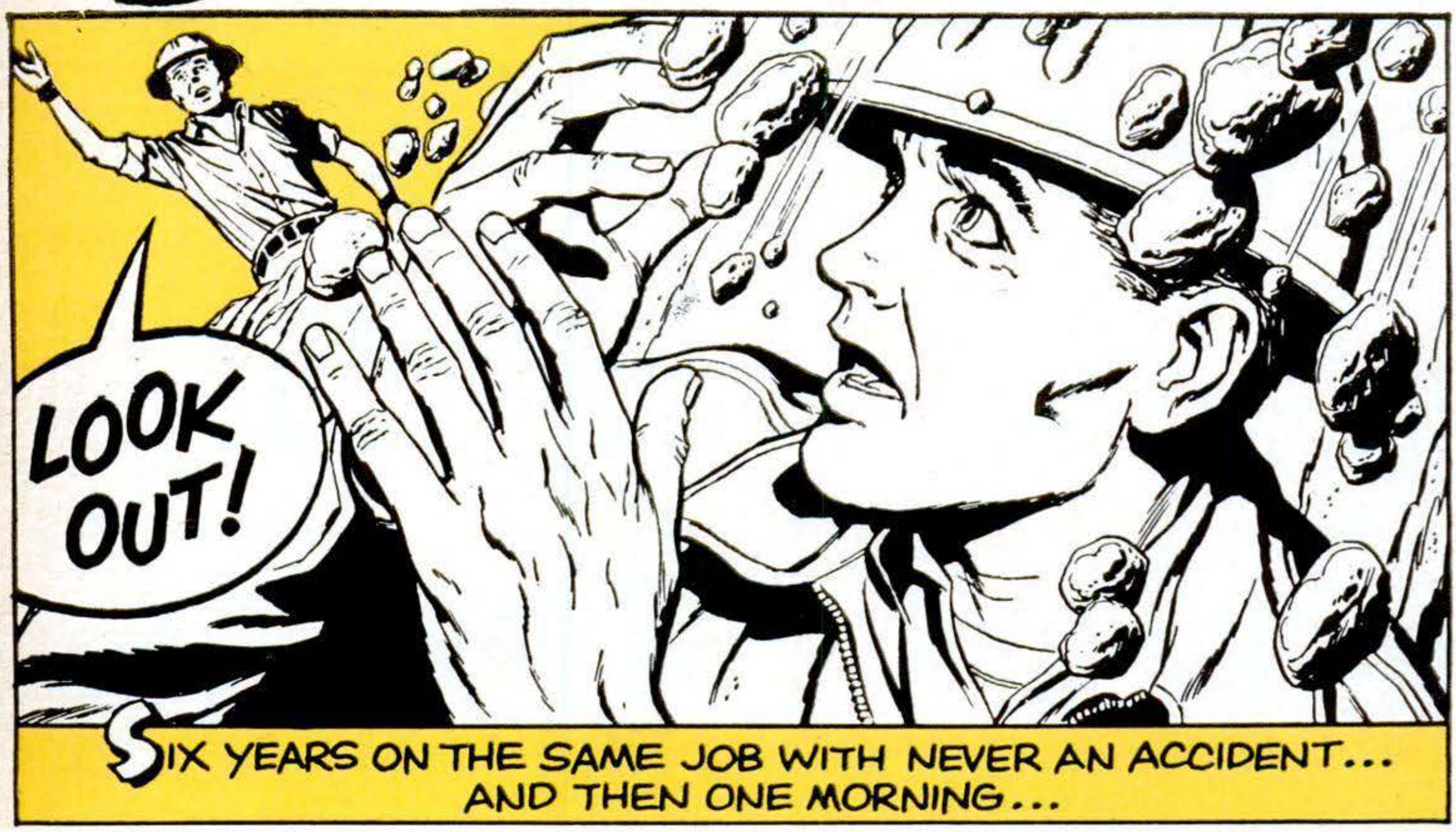

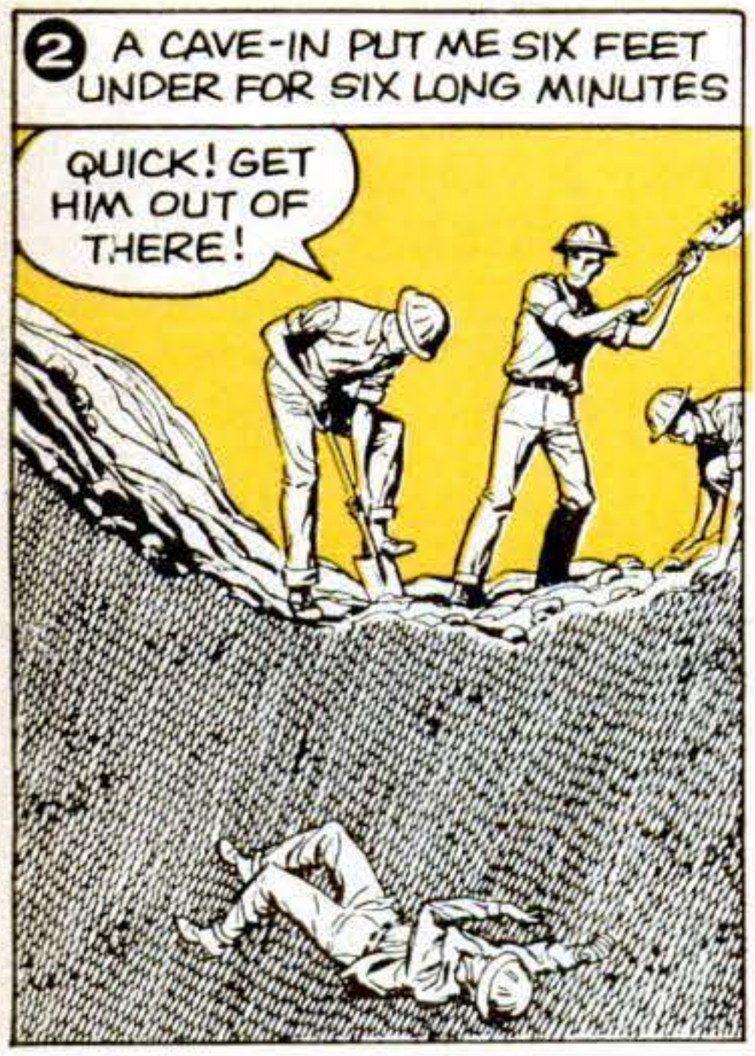

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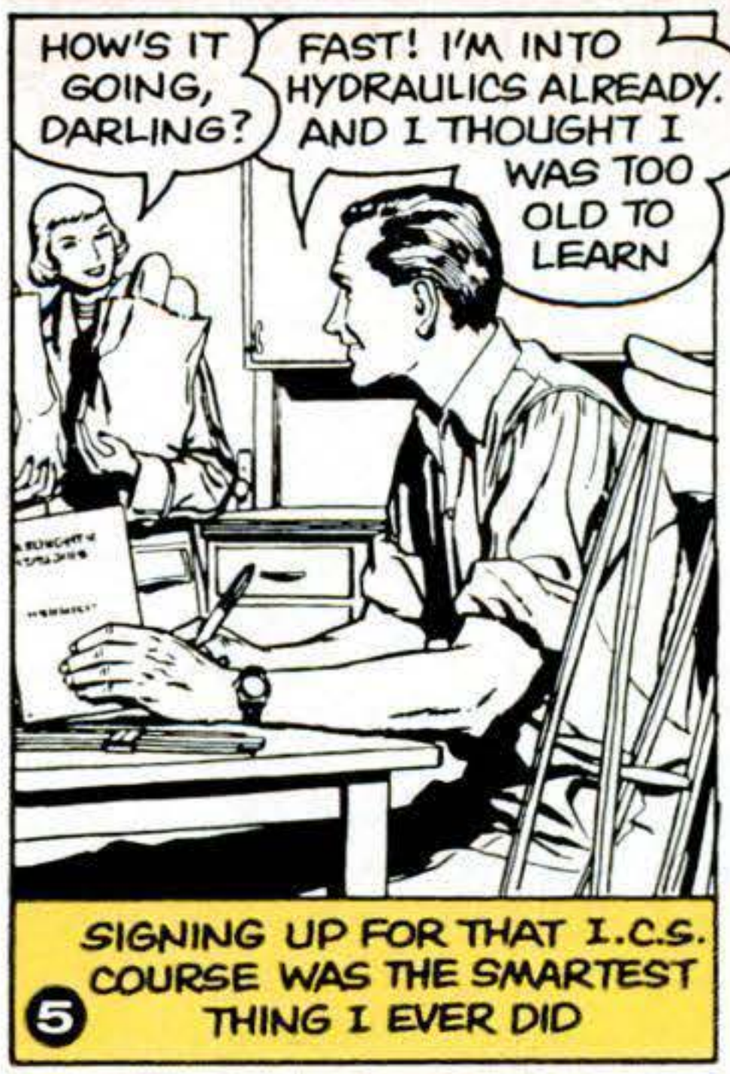

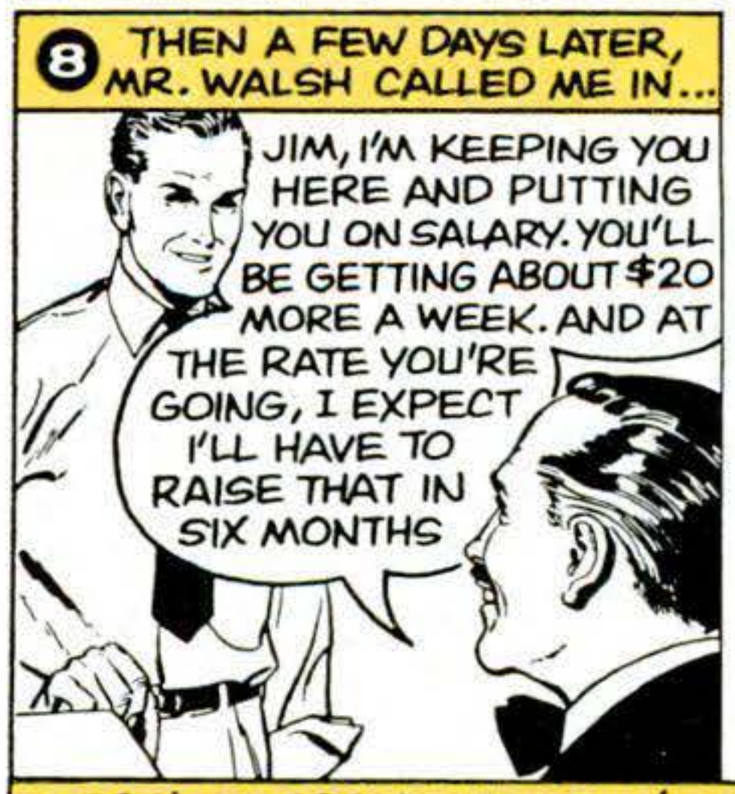

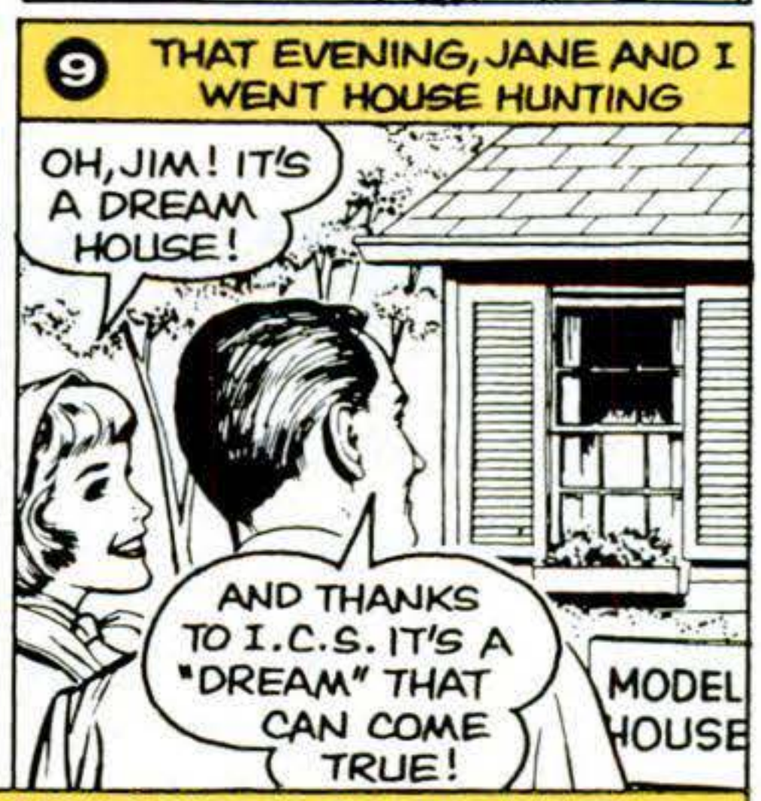

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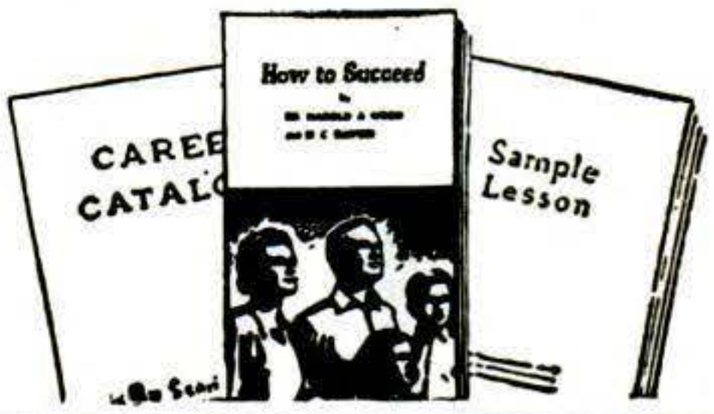

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PS readers talk back

The Four-Legged Cops

As a retired "cop" (New York City Police Department), "Canine Cops Put Teeth in the Law" [Jan.] aroused my interest.

Mr. Gannon failed to mention that in the early Thirties New York City maintained a Dog Patrol, and had a training school for the dogs.

By far the greatest number of crimes in the city today are assault, in all its degrees, as evidenced by the rising statistics concerning rape, muggings, and juvenile street-gang fights. A dog patrol would prove the ultimate in deterrence for these.

EUGENE J. ROZENBURGH, NYC.

. . . Less than a year ago our police department added two dogs to the force and they've been doing a wonderful job. Corky, an 80-pound shepherd, recently pursued and captured a gunman. On order, Corky chased the man several blocks, attacked his gun arm and disarmed him—the gun fell to the curb. Together, Corky and Bismarck, the city's other dog, broke up a riot in a bad part of town, dispersing 35 bottle-throwing toughies in three minutes.

The policemen who go out with them say the dogs like to work. They lie down quietly in the patrol cars (each patrols nightly with a policeman in a station wagon), but they're up like a flash on order. Yet our school children find them docile enough to pet.

L. B. McDow, Paterson, N.J.

Living in a House on Wheels

Your article on the mobile home ["Coast to Coast in a Dodge Motor Home," Jan.] was good but a little misleading. We have a 1961 model, and we start our ice cubes in the late evening. That way, we have a coating of ice by morning, avoiding water slopping in the refrigerator. We never drive over 50 m.p.h. We have a family of five, plus a German shepherd, and have learned to make 30 gallons of water last all day, with showers.

CHARLES HURLBERT, Palos Heights, Ill.

. . . As the owner of a Dodge Motor Home for nearly a year, I think Devon Francis, depicting his month's experience, gave an unfortunate picture as to the value of such a unit.

We also experienced some of the difficulties described, but both dealer and manufacturer were most cooperative in correcting defects without charge. We get better gas mileage and higher top speed than the article mentions, plus wonderful roadability and driving ease. Furthermore, we find our older, smaller model quite satisfactory for six persons, although Mr. Francis says that he found the big one cramped for four.

REV. JOHN AHERN SCHULTZ, Ambler, Pa.

One Way to Foul Up a Motor

I have a '60 Mercury with a 383-cu.-in. engine. It's perfect except that it consumes a quart of oil every 600-800 miles. Somehow there was not enough friction (a hard block, maybe) to seat new rings I had installed. I

have heard that Bon Ami added through the carburetor can effect this increased friction. Is this a normal procedure?

D. N. ABOUDARA, Roanoke, Va.

No. Under no circumstances use an abrasive.

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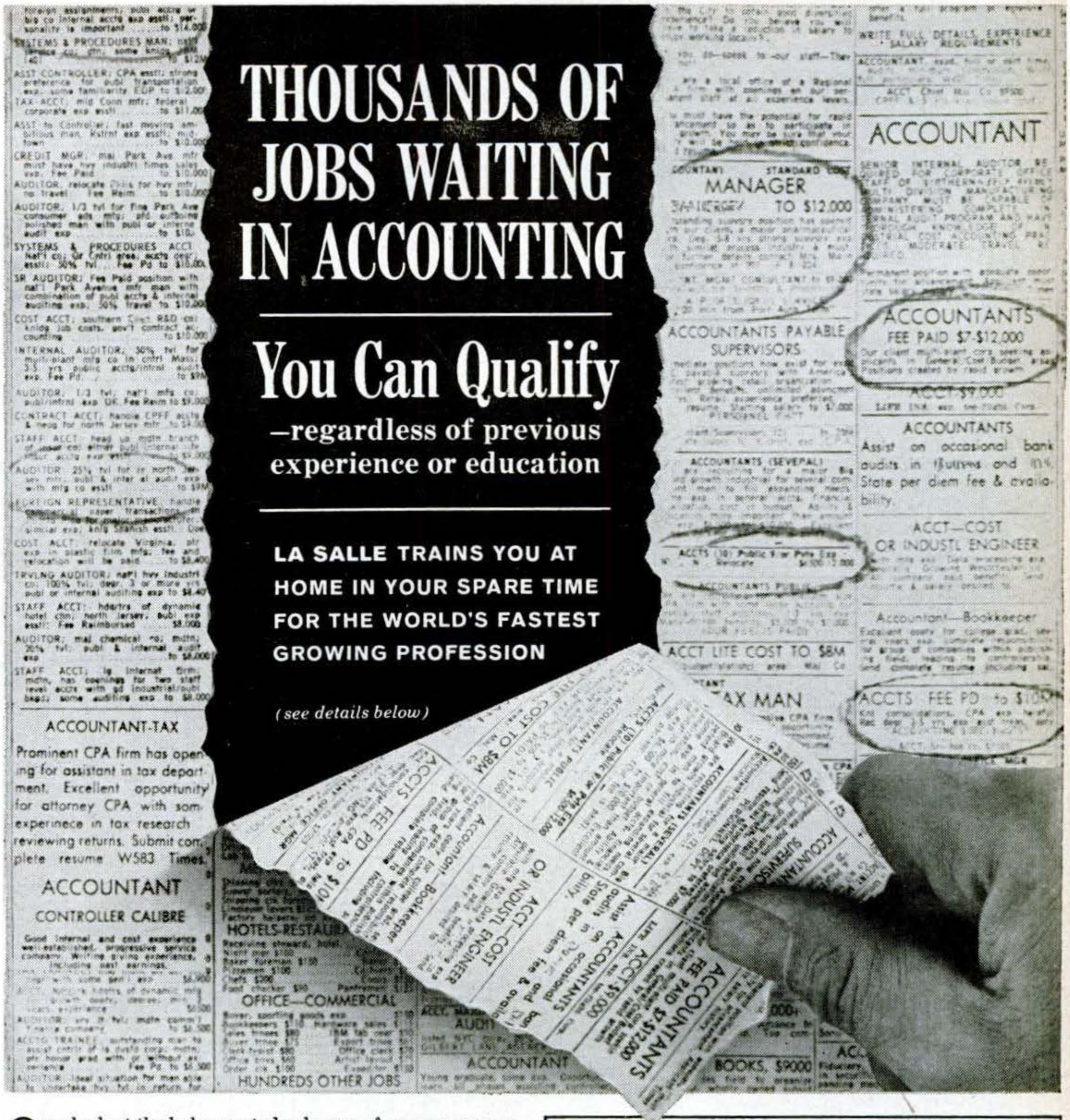

ONE look at the help-wanted columns of any newspaper will quickly show you how the need for Accountants has vastly expanded. Salaries keep going higher. Promotions are rapid. And the demand is still increasing.

"YOUNG MAN, BE AN ACCOUNTANT. The whole profession makes good money. According to a recent survey of 1,700 chief executives, more of them started in finance and accounting than in any other department. There have never been enough accountants, and now those who retire must be replaced as well as supplying the mounting demand." —**Esquire Magazine**

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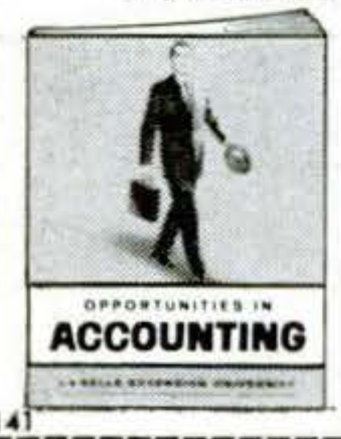

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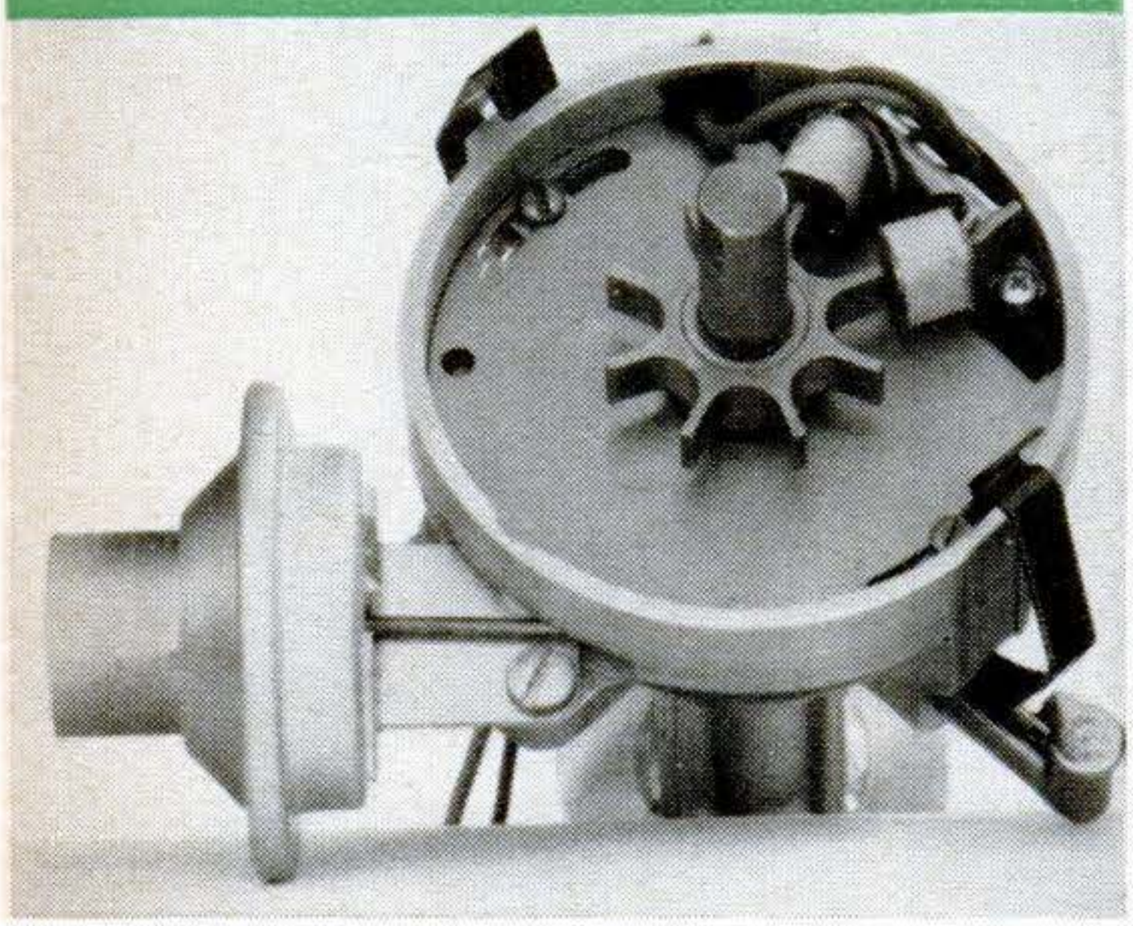
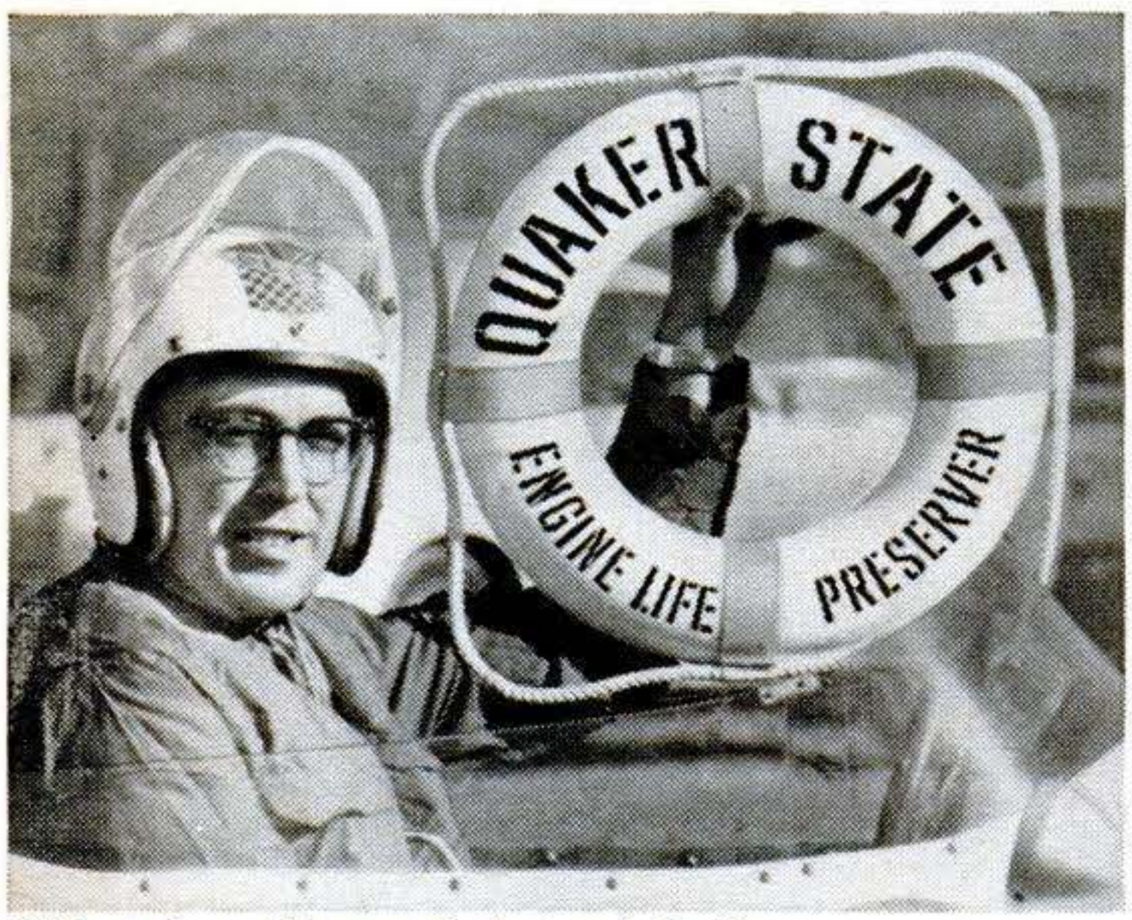
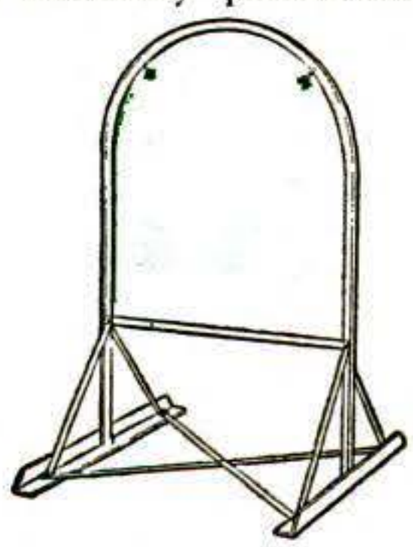


Can you identify this device?



What does this symbol stand for?

Pictured at top is an all-electronic ignition system. The life preserver, below, stands for Quaker State Motor Oil — because it actually preserves the life of your engine best. Made from 100% pure Pennsylvania Grade Crude Oil, Quaker State gives every car longer-lasting lubrication, top protection. Always insist on Quaker State—the best engine life preserver.



QUAKER STATE OIL REFINING CORP., OIL CITY, PA.

Have you checked other sources of oil loss—valve guides, rear main-bearing seal?

Parking—European Style

Could American cities and towns take a lesson in how to handle street parking from the French and Italians? I think so.

In Paris or Rome when you park on a restricted street (one with a one-hour parking limit) you merely hang a little card inside your windshield. The card has a rotating disk that

you set. In one slot it shows the time you parked. With this, in a second slot, appears the time you have to leave. The local policeman passing along checks the cards. If your time is up, you get a ticket. If you have foxily set an arrival time later than your actual arrival, and later than the time he makes his check, you also get a ticket.

There's no nonsense of parking meters and fishing around in your pockets for nickels or dimes. The cards are free, giveaways from the gas companies. The one I used in Rome last year came from Supercortemaggiore, *la potente benzina italiana*—the powerful Italian gasoline. One side *(mattino)* is for morning, the other *(pomeriggio)* for afternoon.

BUD HOWARD, Brooklyn, N.Y.

Strangest Dwelling Ever Built

Congratulations to Alden P. Armagnac for the excellent reporting job he did on Goodyear's space station. It was an accurate and interesting report and covered the entire space-station concept in depth. His overall familiarity with space vehicles resulted in what I consider the best reporting job so far on our space station.

W. J. WEISER
Goodyear Tire & Rubber Co., Akron.

Heating Tape—Don't Lap It!

In "Hints from the Model Garage" [Dec.] you describe a method of warming up a battery for faster cold-morning starts, using a tape made for warming outdoor water pipes.

I have just had my first introduction to heating tape. The instructions say not to cross tape,

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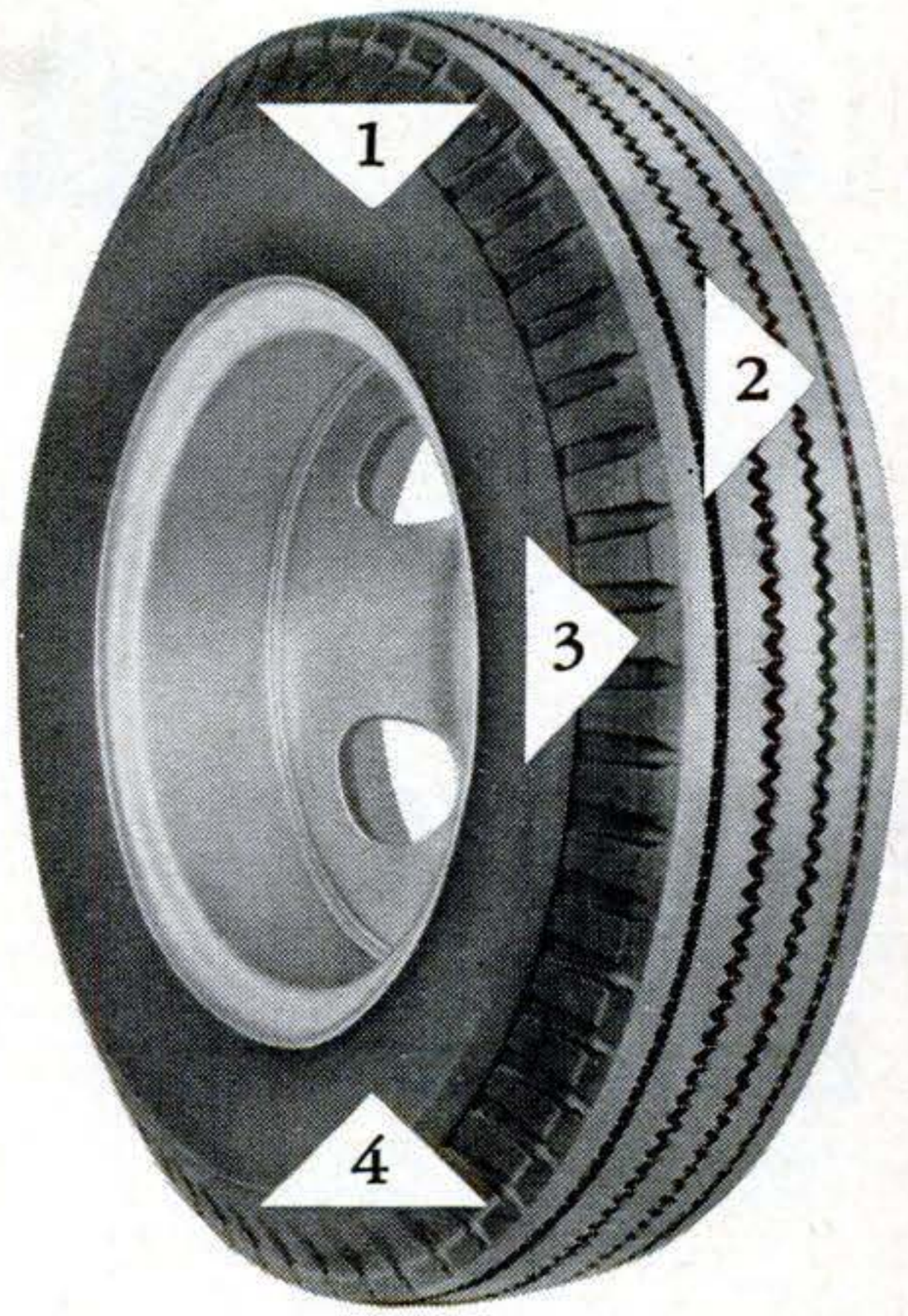

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"I Made $510.00 in One Month's Spare Time"

—says Earl Reid of Ohio

THE FREE BOOK offered below was a big first step ahead for men like Earl G. Reid of Thompson, Ohio, who says: "In one month I took in $648, of which $510 was clear. I work only part time – do a lot of service calls on ranges, dryers – also house wiring and electrical maintenance."

YOU CAN "BEEF UP" YOUR INCOME, SPARE TIME, OR FULL TIME, WHEN YOU LEARN THIS WAY TO

Fix Electric Appliances

Like Earl Reid, many others, YOU can now have a steady, good-paying "business of your own" right in your home. Spare-time at start, full-time later. No experience needed, no big investment. Learn how to Repair Electric Appliances. Many men now make $3 to $5 an hour!

FOUR HUNDRED MILLION Electric Appliances are in use right now in American homes. Seventy-six million MORE are bought each year. People need them fixed, good times or bad. YOU make good money doing it. Work in your own basement, garage, even on kitchen table. You need only few simple, basic tools. We train you, at home, to make steady money – earn while you learn.

Quick, Sure Way to Learn Everything You Need to Know

Our 24-page FREE Book tells how you can "cash in" on America's Electric Appliance Repair boom.

FREE Sample Lesson shows how our easy, clearly pictured instruction prepares you for top earnings and a profitable future in this big field. All for less than 20¢ a day.

At no extra charge we even provide all parts to assemble your own sturdy, portable Appliance Tester. It shows you where to repair, speeds your work, makes sure each job is done right, ready to collect the cash coming to you.

Here's the big-demand business you've been looking for! – and the chance to train for it with methods proved successful for over 45 years. Get your Free Book, Free Lesson *now*. Mail coupon, letter, or postcard to: **National Radio Institute, Appliance Division, Dept. BC3, Washington 16, D.C.** (No obligation, and no salesman will call on you.)

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Please send me Free Book about your Electric Appliance Repair Course and a Free Sample Lesson. I am particularly interested in:

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as heat will be increased in this area, resulting in the melting of the outer coating—and a short. The tape is shown folded over in your hint.

M. R. BROOKS, Berwyn, Ill.

Right you are.

Hauling a TV Tube

It was with mixed horror and fascination that I stared at the picture with the tip on how to haul a TV tube in your car [Dec. p. 138]. As a radio-TV technician, I shudder at the thought of that safety (?) belt caressing the most tender spot of the glass-faced monster.

Never handle a picture tube by its neck, or place any strain on the neck or the area where the neck flares into the bell. Never strike a picture tube anywhere. And never carry one inside a car; put it in a padded container in the trunk.

ELMER H. BLOECHER, Fort Yukon, Alaska.

Those Space-Age Schoolmarms

I enjoyed "Teaching Machines—Do They or Don't They?" [Dec.] more than any other article. Especially I enjoyed the PS Teach-Yourself Chase.

I took a teaching-machine course two years ago in advanced algebra and electronics, and finished one year's work in 4½ weeks.

DON KORNBLUM, Park Forest, Ill.

The Weakest Link?

Hubert Luckett ["50,000 Miles Without a Tune-Up?" Dec.] is not kidding when he says the present ignition system is one of the weakest systems in an auto engine. My station wagon, purchased in October, now has almost 3,000 miles on the odometer. Two weeks ago, without warning, the car suddenly stalled and refused to start. The diagnosis: failure of the points and condenser. I notice that in most warranties the ignition system is excluded.

The article convinced me. I'm for transistor ignition. I think it would help in cold-weather starting; it's often –20 deg. here. Also, most of my driving is done above the 5,250-foot elevation markers.

REV. ORVILLE E. LANHAM,
White Sulphur Springs, Mont.

. . . I enjoyed the transistor-ignition article and was so impressed that I installed a system on my '59 Chevy six.

I mounted the transistor unit on the firewall, and the coil where the old one was. It took me a little longer than I expected because I had to cut into the wiring harness, and I like to solder all my connections. I took out the old condenser and temporarily used the old

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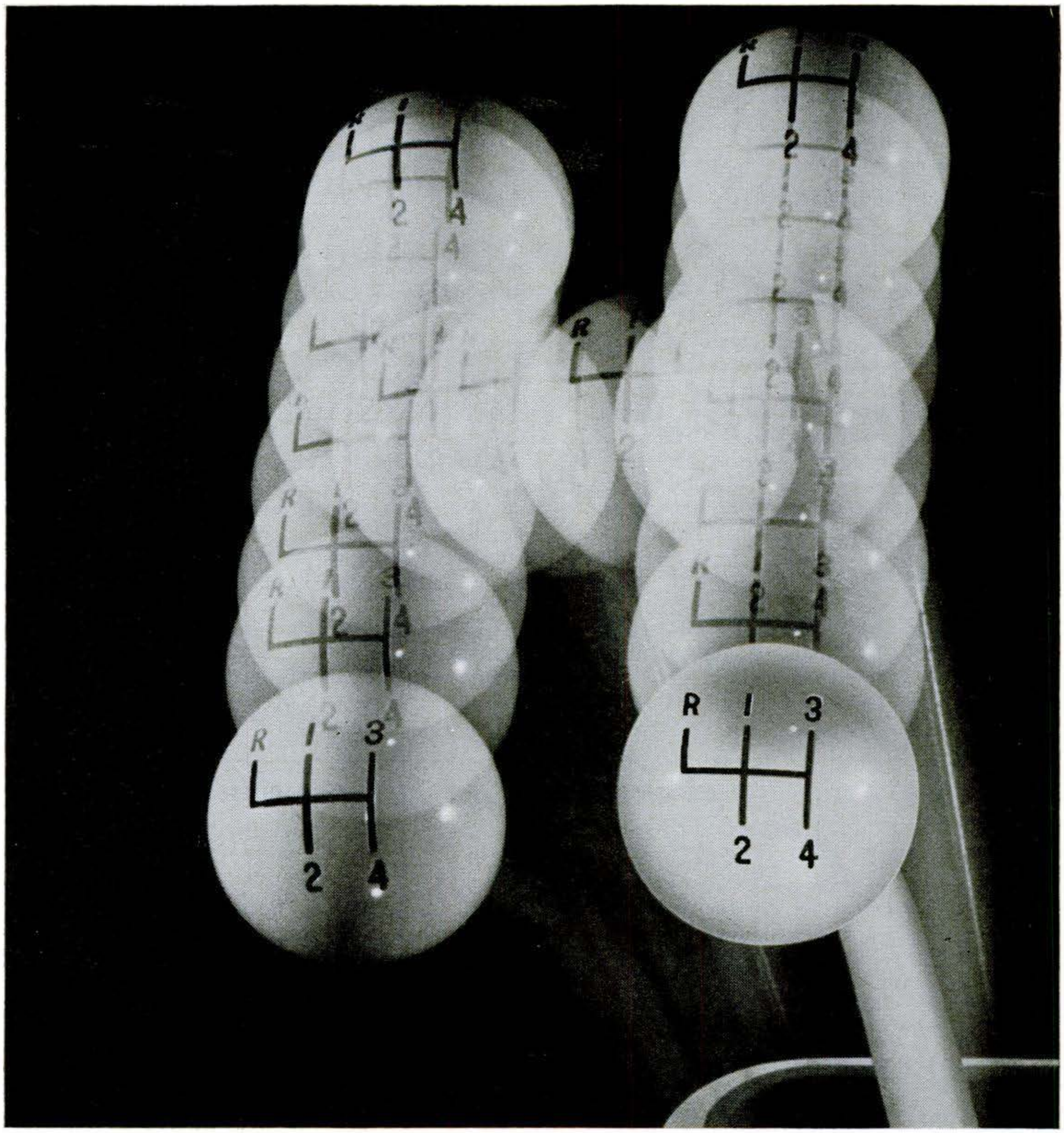

More Fun Than You Can Shake a Stick At—*Chevrolet didn't exactly invent the 4-speed transmission, but we have certainly contributed to its popularity, starting with the Corvette back in 1957. Just look at all the people who are equipping their new Jet-smooth Chevrolets with that 4-speed Synchro-Mesh stick shown above. One drive will tell you why. Its crisp, precise response lets you get the most from Chevrolet's superb performance in every driving range, under all road conditions. You upshift and downshift smoothly and easily through every gear like a born virtuoso. Chevrolet 4-speed Synchro-Mesh is an extra-cost option in all three Chevrolet series, available with any of five optional V8's and with two low-gear ratios—the 250- and 300-hp Turbo-Fire 327's and 340-hp Turbo-Fire 409 (2.54:1) and the 400- and 425-hp Turbo-Fire 409's (2.20:1 and 2.54:1). So take your pick. Your Chevrolet dealer is the man to go see. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.*

CHEVROLET

The make more people depend on

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points with 11,000 miles on them. The engine ran swell.

I can't give any information on the results yet, but I do think the car has a little more pep and runs a little smoother.

RAY MCMAIN, Buffalo, N.Y.

The Sound-Off Level

Your "noisy" blind-man's level ["Carpenter's Level Sounds Off," Dec.] seemed very useful to me. However, there is a simpler solution.

Two mercury switches and two lights could easily indicate an off-level condition, with the added bonus that you would not disturb the delicate factory adjustment of the bubble. In most cases when the bubble cannot be seen, one side of the level is still in sight. Mounting the lights in through-holes permits them to be seen from either side. The switches could be positioned either for both lights or no light when level, as desired.

HARRY WIERSDORFER, Hamburg, N.Y.

That Old Blow-by Plumbing

Positive crankcase ventilation ["What You Should Know About PCV," Dec.] is not new. In the early 1950s I had a system installed on my 1948 Olds 98. It was made by the Donaldson Co. of St. Paul. The valve was made to fit between the carburetor and manifold. The crankcase end went to the vent pipe, which was plugged half shut. It paid for the cost of installation many times over.

S. T. MCDADE SR., Flint, Mich.

. . . How corny can we get about this PCV? Dykes auto book about 1913 had a remedy for sticking valves: Run a hose, large enough to fit in the crankcase filler pipe, to the air scoop on the carburetor. The oil-laden air from the crankcase then will pass through the carburetor and combustion chamber, assisting in oiling the valves. Cost: about 75 cents, not $2 to $5.

H. A. JONES, San Diego, Calif.

Covering the Uninsured

Your "latest tips on insurance" [Detroit Report, Jan.] are true until you get to uninsured-motorist coverage. New York State also has coverage for personal injuries inflicted by an uninsured motorist (maximum limits, $10,000 per person and $20,000 per accident). Perhaps your statement that three states have uninsured-motorist funds was confused with the fact that three states (Mass., N. Y., N. C.) have compulsory automobile insurance.

Mention should also be made that your own basic liability policy also covers you while driving another's car.

ARMAND A. LOWELL
Hempstead, N. Y.

INVITATION TO EXTRA COMFORT AND LONGER WEAR—

Charles CHESTER SERVICE SHOES with NEOPRENE SOLES!

Crafted by Charles Chester Shoe Mfg. Co.

CHARLES CHESTER service shoes—sold direct-from-factory-to-wearer only by local community representatives—are famous for their solid shoe value. STORMSEAL'D construction, flexible elk-tanned leather uppers and heel-to-toe air cushion innersoles bring genuine comfort to men on the job. Soles and heels of tough Du Pont Neoprene give extra-long wear . . . more miles to the pair. Neoprene resists oil, grease, chemicals and cold weather cracking . . . helps reduce fatigue because of its lasting resilience. Write Du Pont, Department PS-3-NS, Wilmington 98, Delaware.

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Write for style folder and name of your local Charles Chester representative: Charles Chester Shoe Mfg. Co., Brockton 64, Mass.

Better Things for Better Living . . . *through Chemistry*

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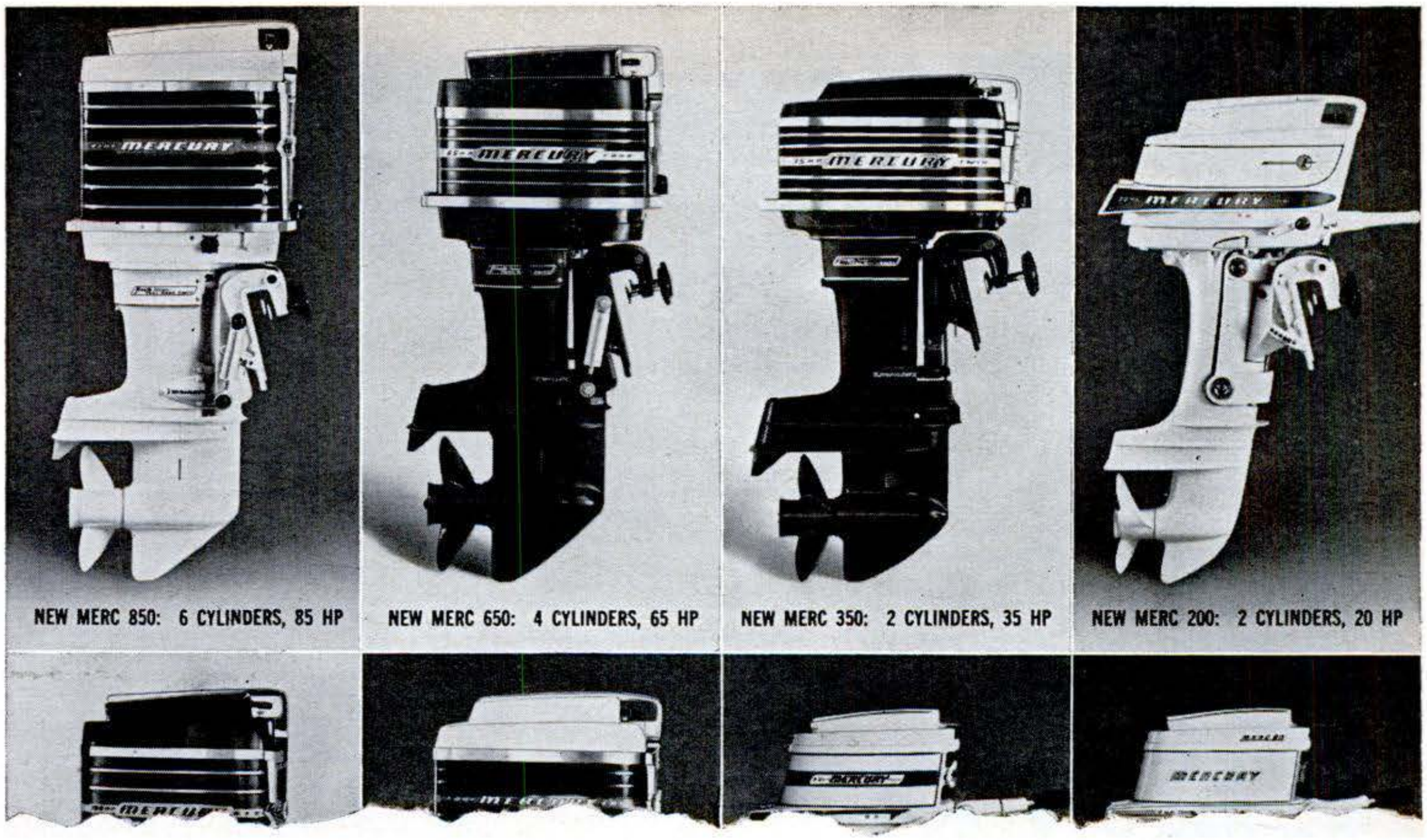

NEW MERC 850: 6 CYLINDERS, 85 HP | NEW MERC 650: 4 CYLINDERS, 65 HP | NEW MERC 350: 2 CYLINDERS, 35 HP | NEW MERC 200: 2 CYLINDERS, 20 HP

HERE'S HALF THE NEWS FOR '63

The only new outboards this year are branded "Mercury." Eight new models offer you a range of horsepower from 6 to 100. Here's just half the news:

NEW MERC 850... now a full 90 cubic inches for more lugging power with heavier loads. Here's an 85 hp outboard that will out-muscle anything on the water (except the Merc 1000). It features Power-Dome combustion chambers and Jet-Prop exhaust for minimum noise and maximum fuel efficiency. A wide range of props lets you match the power to your purpose.

NEW MERC 650... Mercury's most powerful 4-cylinder motor. Here's a 65 hp outboard that gives you all the advantages of an in-line, small-bore, short-stroke engine. Power-Dome combustion and a new balanced manifold system give you smoother idling and greater fuel economy. Hydraulic shock absorbers protect you and your boat. Jet-Prop exhaust silences the sound and buries the fumes.

NEW MERC 350... This lightweight, 35 hp Merc was the basic test engine from which the Merc 1000 and Merc 650 were developed. As a result, this twin has had more testing and refining than probably any other outboard. This year, we decided to market it with the quality features of the Merc 1000 . . . Power-Dome combustion chambers, reed valves, and extra-husky rods, bearings, pistons and crankshaft. A new high-output magneto starts it with a flip of the wrist, or with the optional electric starting. A single lever gives you one-hand control of gear selection and speed. A new high in dependability and value!

NEW MERC 200... This is a brand-new 20 hp engine from powerhead to Jet-Prop exhaust. The Glide-Angle design has been changed to accommodate the new full gear-shift which can now use Ride-Guide steering and standard Single-Lever control. It is available in long and short shaft. The crisp, sculptured styling of the forward slant lends beauty and function by letting it slip through weeds and over obstructions. For *portable* power this is a beauty. And remember, *it's all new!*

MERCURY

100, 85, 65, 50, 35, 20, 9.8, and 6 hp outboards

MerCruiser Stern Drive Power Packages

310, 225, 190, 140, and 110 hp gasoline/100 and 39 hp diesel

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GUARANTEED TO DO THE WORK OF $40, $60, $100 UNITS

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★ LIFETIME ENGINEERED

REVOLUTIONARY PATENTS DECREASE COSTS, INCREASE EFFICIENCY

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8" TILT ARBOR POWER SAW KIT

$9.95 f.o.b. factory

Wt: 12 lbs.
If desired, for easier work alignment: RIP FENCE, $3.50 add'l.

KIT INCLUDES: • Complete blade carrying mechanism with depth of cut control • Ground spindle with saw flanges • Pre-oiled bearings • Angle of tilt control • Mitre gauge • Motor mount assembly • Attractive steel front control panel • All needed brackets, screws nuts, bolts • ABC assembly plans • Patterns for sturdy base, massive 20" x 24" table • Full instructions

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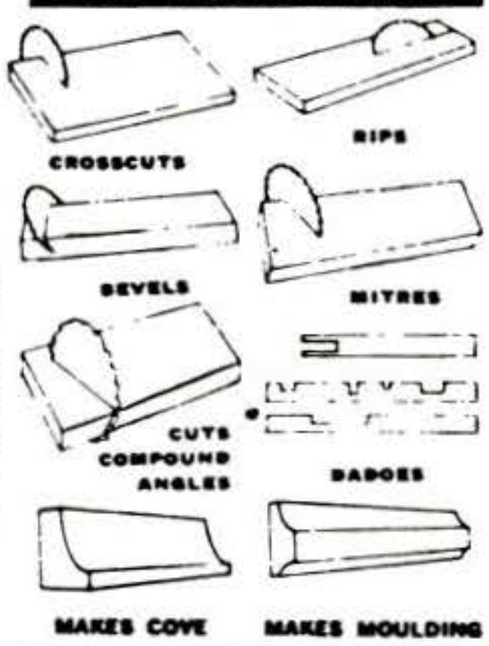
GUARANTEED TO DO THE WORK OF $50 BENCH SAWS



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Optional Faceplate for turning bowls, trays, lamp bases, rosettes, etc. $2.50

Complete as shown

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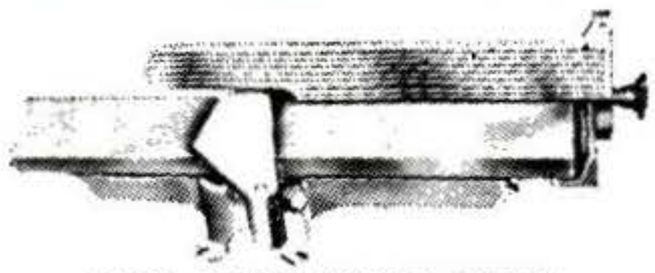
100% precision ground cast iron and steel.



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1/3 HP ELECTRIC MOTOR

GE List Price—$27.00
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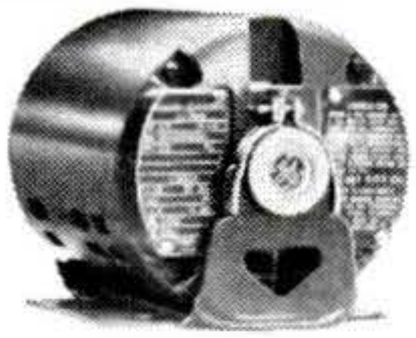

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Brand new factory fresh GE electric motor. Standard mounting bracket for all types of home appliances, pumps, power tools, fans, etc. Wt.: 17 lbs. FULL ONE YEAR WARRANTY. LIMITED QUANTITY

32" RADIAL DRILL PRESS

$29.95 F.O.B. Factory
½" Cap. Gear Chuck Inc.
Shipping Wt. 30 lbs.

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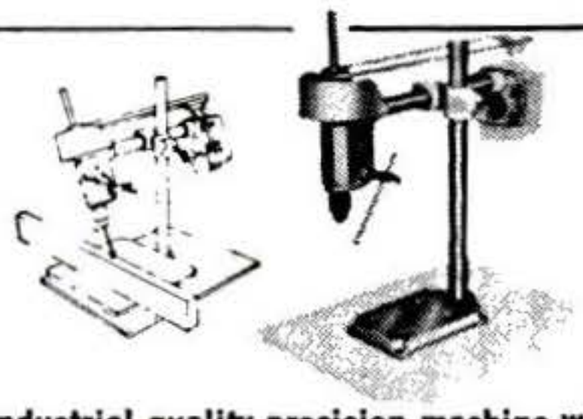

Industrial quality precision machine with all features of standard drill press, many extras. Head raises, lowers. Greatly increased depth of throat. Can be pre-set to any angle or position for on-or-off table drilling . . . even horizontal drilling. All cast iron and steel. UNCONDITIONAL 10 YEAR GUARANTEE

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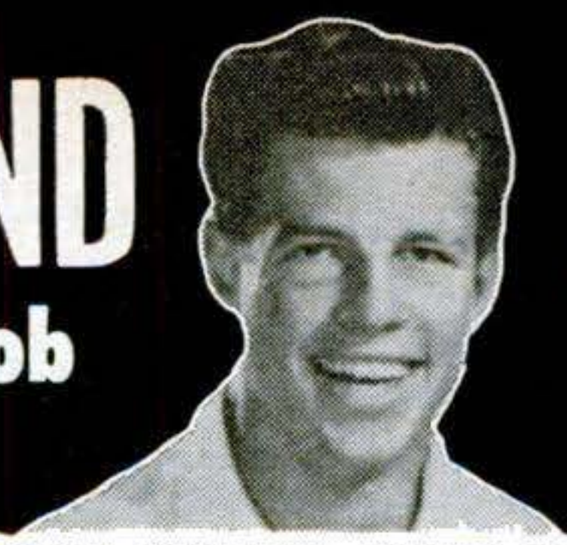

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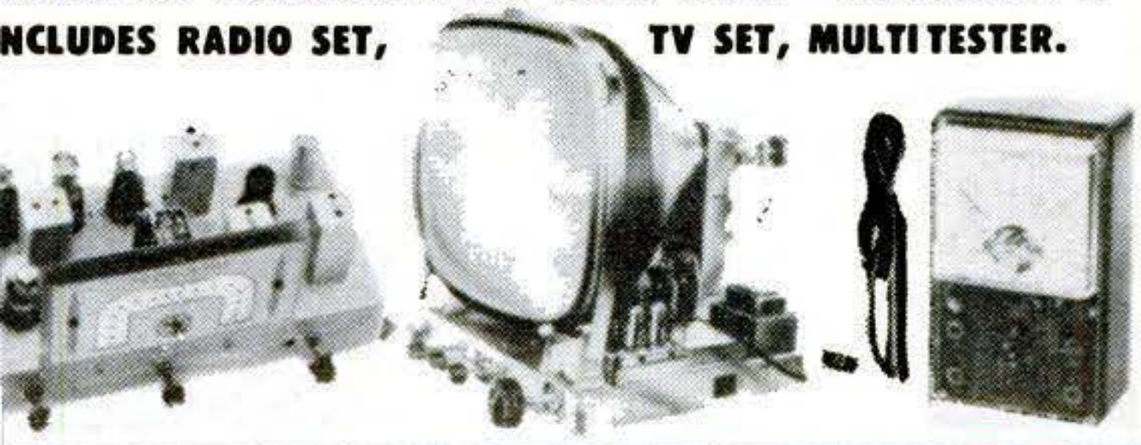

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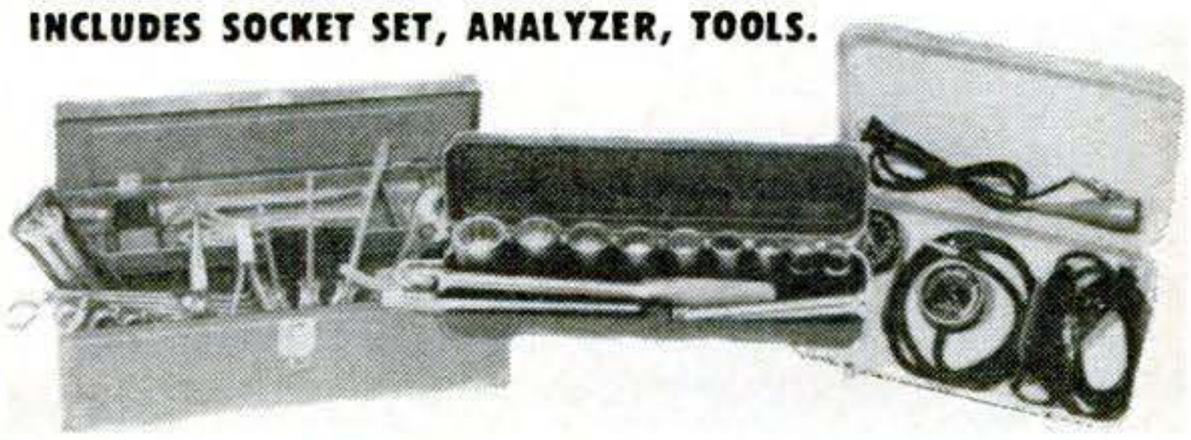

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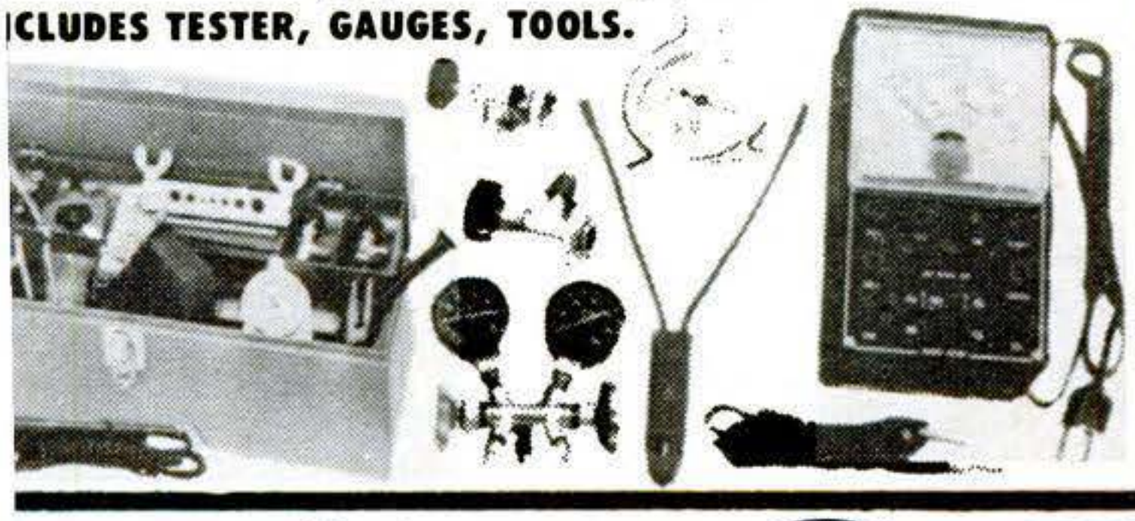

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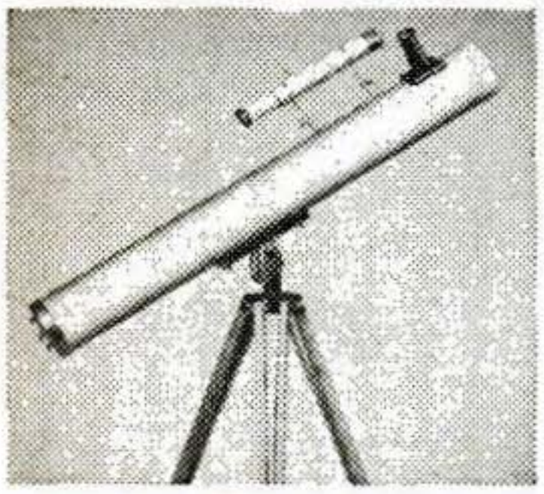

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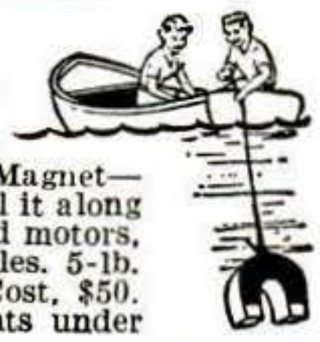

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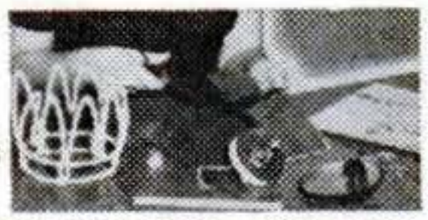

See Nov. "Popular Science" Article Featuring This Wonder Material in Christmas Lighting Projects.

This amazing material breaks up white light into deep, rich hues. Sparkles with all the color of the spectrum. Comes alive with the flashing brilliance of rainbow magic. Now you can create spectacular color-coordinated effects and decorations—inside & out—convert old, unwanted earrings, cufflinks, pendants, etc., into beautiful, iridescent pieces of jewelry. Real conversation piece, too. Kit contains 8½" x 5½" sheets of see-through (transmission) and reflecting type grating, mounted circular grating, unmounted transmission and reflecting types, round pieces of mounting, double-faced mounting tape, stereo viewer, and Edmund Diff. Grating Idea Book.

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Science newsfront

BY WALLACE CLOUD

A monthly report: What's going on in science and why it's important to you

SPACE

Telstar's second career

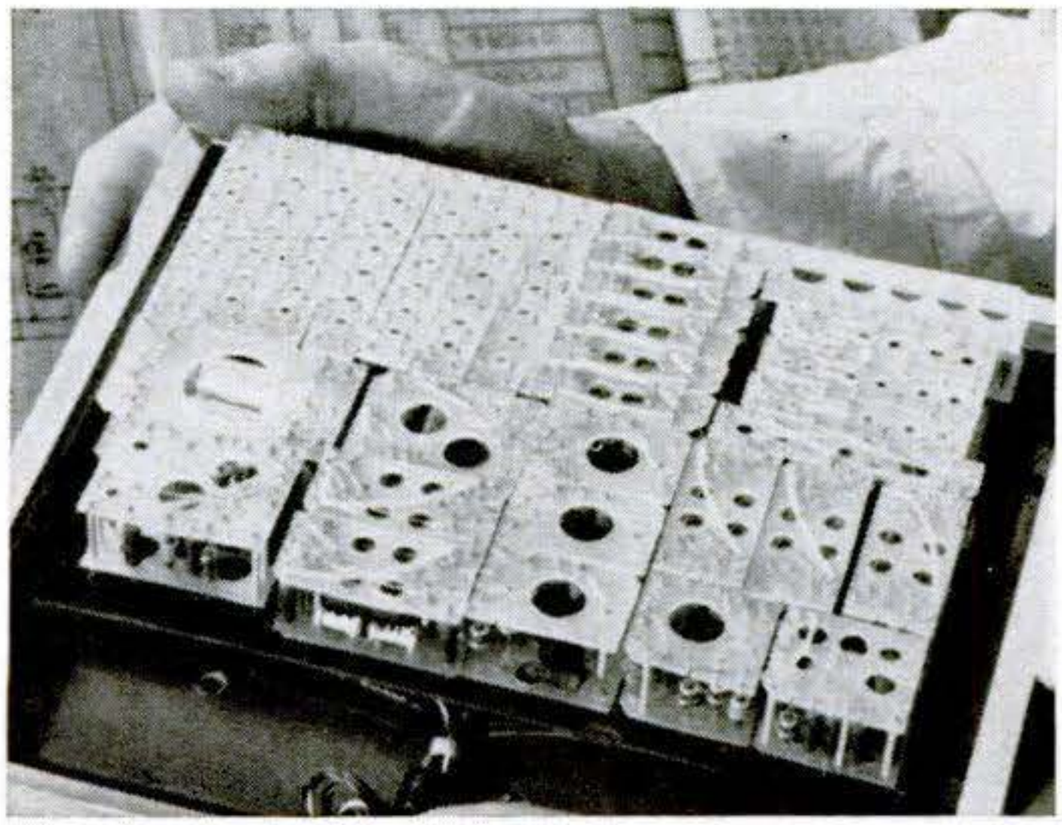
How do you revive an unconscious satellite? That was the problem facing Bell Telephone Laboratories scientists who turned Telstar back on after it had been out of commission for six weeks.

When Telstar [See "Satellite to Put Europe on TV," PS, June '62] stopped relaying transatlantic signals on November 23, its designers had a pretty good idea why.

Some transistors are susceptible to radiation damage. High-energy electrons ionize gas and other materials in the transistor's protective can. This produces charged particles that are trapped on the surface of the transistor by the electric field caused by its normal bias voltage.

This wasn't expected to cause trouble, but in the Van Allen belts, Telstar encountered radiation 100 times greater than anticipated.

The communications satellite's two command decoders failed, one at a time. Such



units (see photo) interpret the strings of long and short pulses, representing ones and zeroes in binary code, that are sent from earth to tell Telstar's other circuits what to do. Telstar stopped working and there was seemingly no way to command it.

But Bell engineers exposed a similar decoder unit to radiation in the laboratory and found that the "zero gate"—a transistor that recognizes short pulses standing for zeroes in the code—went out of operation. Then they devised a trick pulse that the "one-gate" transistor could recognize as a zero. It was a long pulse with a "notch," or dip, in the middle.

They began sending trick commands to Telstar, got a response, and cautiously approached their objective: to command the satellite to turn its batteries off. Solar power would be left on. Then, whenever Telstar was eclipsed by the earth's shadow, there would be no bias voltage on the key transistor and its surface charge would leak away.

Telstar jumped the gun. Twice, other trick commands were misinterpreted and the satellite turned its own batteries off. After the eclipses that followed, normal command performance was partially restored. Then the batteries were intentionally turned off and complete operation of the satellite was restored.

Bell Labs spokesmen wouldn't predict more than a month of renewed operation. If failure occurred once more, they'd be likely to try the trick again.

Diamonds from the sky. NASA chemist M. E. Lipschutz found tiny diamonds in a meteorite that fell in India in 1872. He thinks they were formed from graphite during a collision in space.

Shortage of scientists? Ninety percent of all the scientists that have ever existed are alive now, says science historian D. J. de Solla Price of Yale.

MEDICINE

Electronics and fertility

How do you find the moment of ovulation in a woman? That's one of the problems dealt with in a recently released U.S.

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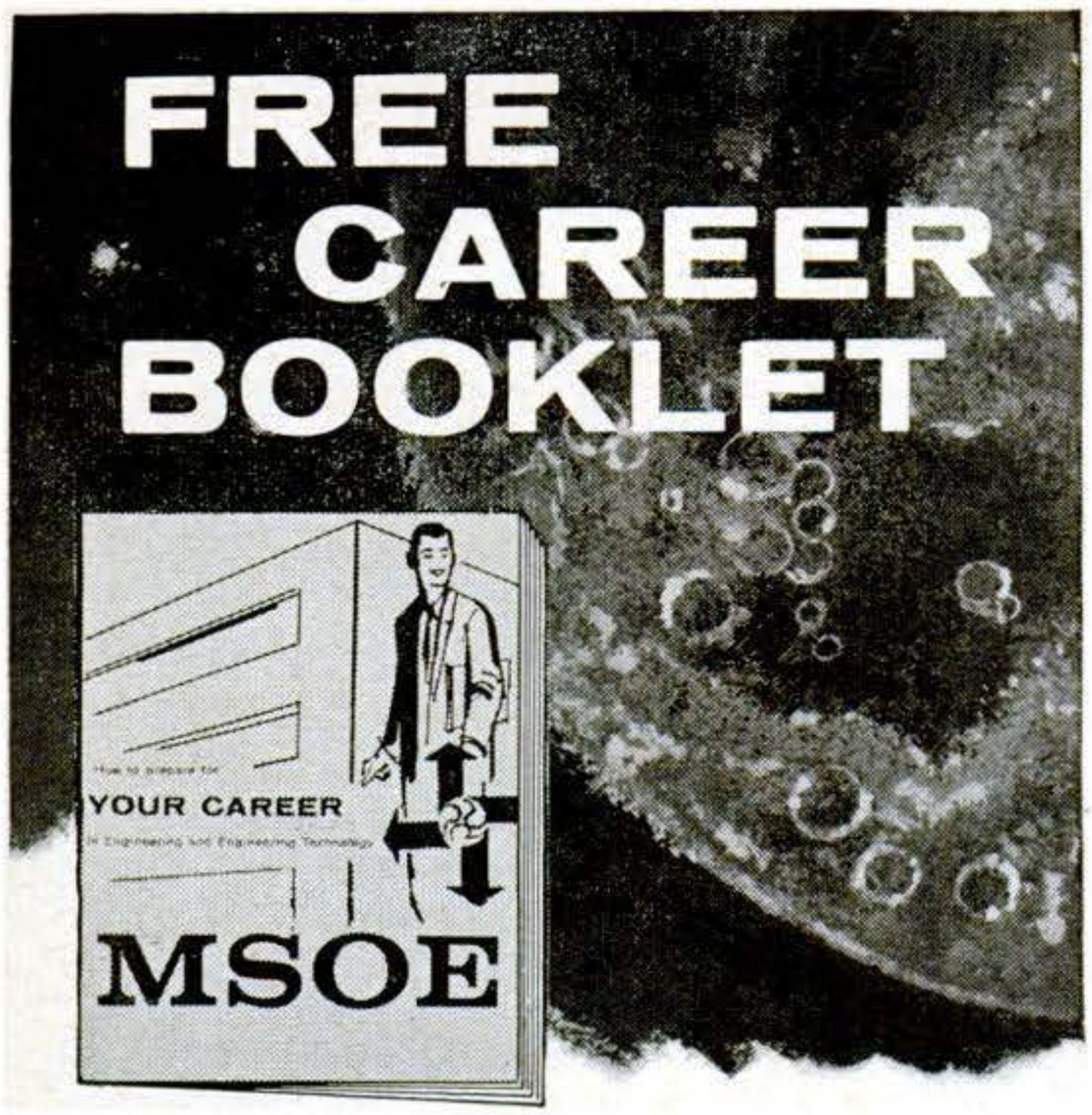

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survey of 382 projects on fertility and birth control. (Total cost: six million dollars.) To help scientists with that timing problem, a new research tool is going on the market this month. It is a "radio thermometer" developed by American Electronic Laboratories, Inc., of Colmar, Pa. It will help pinpoint the moment of ovulation, start of the one 24-hour period in a woman's 28-day reproductive cycle during which the egg cell can be fertilized.

It has been known for many years that ovulation is associated with a change in basal temperature—the temperature of the body when all normal processes are at their lowest ebb, as in sleep. Although women are not consistent, ovulation is frequently signaled by a slight drop in basal temperature followed by a gradual rise to a level a few tenths of a degree higher than before ovulation. Precisely what physiological event directly causes the temperature change is not known.

The usual means of detecting the basal temperature variation, an essential part of the rhythm method of birth control, is for a woman to take her temperature orally every morning before getting out of bed. Charts are then kept as a basis for predicting the usual time of ovulation. But there are many factors that cause inaccurate or erroneous readings.

The radio thermometer is a temperature sensor wired to a tiny, transistorized trans-

New snakebite treatment. Recommended as replacement for the cut-and-suction method is this technique perfected by Dr. J. F. Mullins of the University of Texas: Release emergency tourniquet, immerse bitten arm or leg in ice water or pack in plastic bags filled with crushed ice. If used within 30 minutes after bite, the technique allows the body's own defenses to combat snake venom.

Sticky stitches. Surgeons used to sew up all incisions with catgut or wire. Then came staples. Now surgical glue is being tried. Dr. Bradley A. Straatsma and associates at UCLA report success, in animal experiments, with plastic adhesives used to fasten together fragile tissues after eye operations. The resins hold for about eight weeks, long enough for natural healing to take place.

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We went to the mountain to make 1963 Ford-built cars go 30,000 to 100,000 miles between major chassis lubrications

Quite a task faced Ford Motor Company engineers when they set out to eliminate the traditional trip to a grease rack every 1,000 miles.

Like Mohammed, they went to the mountain—Colorado's Bartlett Mountain. More molybdenite is mined there than in the rest of the world combined. And from molybdenite comes the amazing "moly" grease that helps extend chassis lubrication intervals for Ford-built cars. This grease sticks tenaciously to metal, stands up under extreme pressure and resists moisture, pounding and squeezing. It's slicker than skates on ice!

New, improved seals were developed. Bushings, bearings and washers of many materials were investigated. Slippery synthetics, like nylon and teflon, were used in new ways. It took time. And ingenuity. But the effort paid off when Ford Motor Company was first to offer chassis lubrication good for 30,000 miles or two years—whichever came first (now up to 100,000 miles—or three years—for Thunderbird).

Engineering leadership like this also provides other quality achievements: self-adjusting brakes, use of rust-resistant galvanized steel for vital underbody parts, durable 4-coat baked-enamel finish.

These examples of engineering excellence are just part of Ford Motor Company's success in bringing you quality cars that last longer, need less care and keep their value better.

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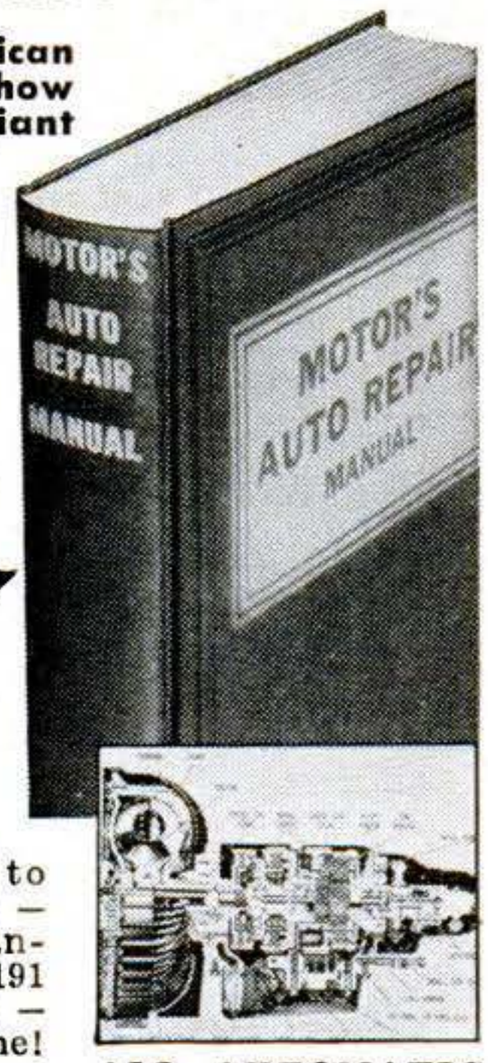

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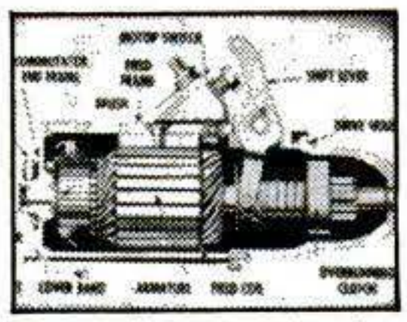

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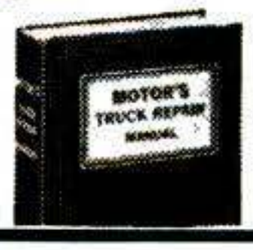

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mitter. Placed within the vagina, it sends out continuous, accurate readings of the body's internal temperature. There is no discomfort or interference with normal functions.

During sleep, the radio signals are picked up by a nearby antenna, amplified, and converted into a graph on a small bedside recorder. The manufacturer says the characteristic dip-rise curve associated with ovulation has been detected and is produced over a three-hour period. The device has not been clinically tested, nor is it certain that it has pinpointed ovulation.

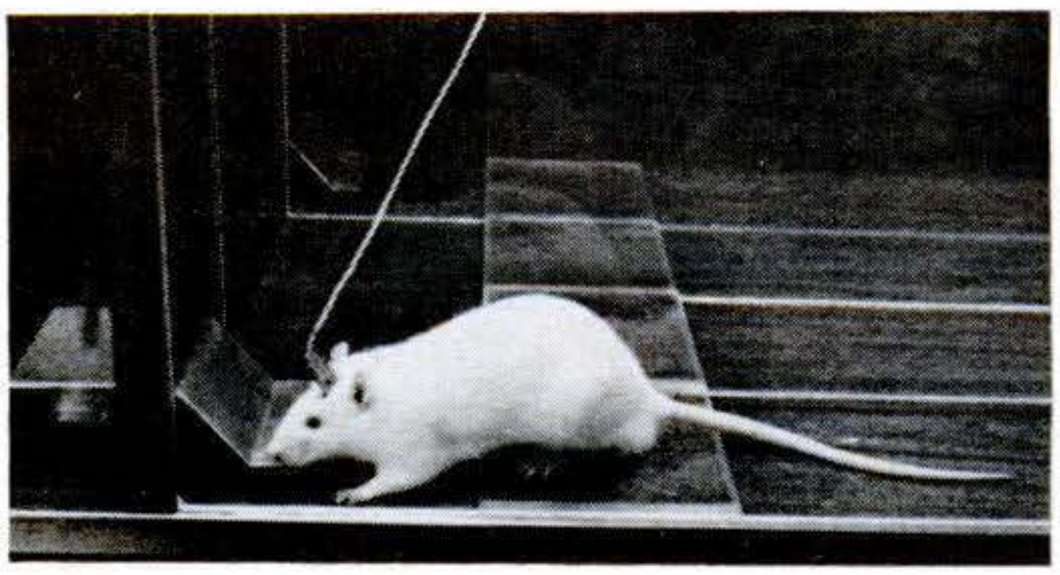
Cost of the radio thermometer ($1,500-$1,800) makes it prohibitive for other than professional use, and it's not likely to provide an improved means of *predicting* ovulation. But doctors dealing with fertility problems can lend the device to patients for home use.

The apparatus can be set up to ring a bell when the ovulation signal is detected. However, if ovulation takes place during the day, it will go undetected, since basal temperatures can be measured only when the body is at rest.

BIOLOGY

Electrified rat

A brain-research technique being used more and more is the implanting of electrodes permanently in the brains of laboratory animals. Weak electric currents can be used to stimulate the brain directly, producing a variety of emotional and physiological reactions.



The rat in the photo has an electrode planted in a "pleasure center" of the hypothalamus, and he's feeling no pain. When he presses the lever he's nuzzling, he feels such intense gratification that he presses

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Dealers operate from a shop, office or home. Equipment is portable . . . the electric Foamovator converts to a carrying case.

At the start, you may want to render service yourself. This business is easy to learn . . . easy to start . . . so easy to service that women dealers often do it. We prefer you have no experience . . . not have to "unlearn" old scrub methods.

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New "miracle" fabrics and light colors (which soil faster) have created a growing demand for the Duraclean quality of cleaning.

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We show you 15 quick ways to get customers. You have pre-tested newspaper and yellow page ads, commercials, and a full mailing program.

Your services are backed by Parents' Magazine Seal, McCall's "Use-tested" approval and American Research & Testing Laboratories.

Duraclean dealers find **voluntary** and **repeat** orders a major source of income. Customers are so enthused they tell friends and neighbors. Furnishings stores, insurance adjustors, and decorators refer jobs to Duraclean dealers. These year 'round services are in constant demand.

TODAY is the time to own a Duraclean dealership . . . before someone takes your location.

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DURACLEAN not only cleans; it enlivens the fibers . . . revives dull colors. Pile rises with **new life.** Furnishings are used again in a few hours . . . a great customer convenience.

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A moderate payment establishes YOUR OWN business. A day's profit pays monthly payments. Your business can be operating in very few days.

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It's been said, "Opportunity knocks but once at every man's door." This could be that one rare opportunity in **your life.**

It is surprisingly easy to learn this business. You can decide from the information we will send you whether to apply for a dealership. So, with no obligation, mail the coupon TODAY.

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L. Broersma: "Have now completed 5 years with Duraclean. We have never had one complaint."

George Byers: "For University, bill was $2,416. Total expenses $814."

Ed Kramsky: "In 2 years, I now have two assistants, a nice home and real security for my family."

L. Babbit: "I average $400 monthly part time. I'm starting full time."

Russ Day closed 19 jobs from 21 contacts.

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L. Falls: "I cleaned 1,900 sq. ft. of carpet in one day. Made $135.

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Aldon Carpet Mills: "We approve this process. We are pleased with the texture restoration."

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Trendline Upholstered Furniture: "We recommend Duraclean as the safest and most effective method of cleaning fine furniture." **Kingston Mills:** "It is our intention to recommend Duraclean Service."

Modern Tufting Co.: "Duraclean is superior to any on-location cleaning process with which I'm familiar."

Painter Carpet Mills: "Duraclean is logical approach to carpet cleaning because the tufts are not subjected to the harsh treatment so prevalent in other methods."

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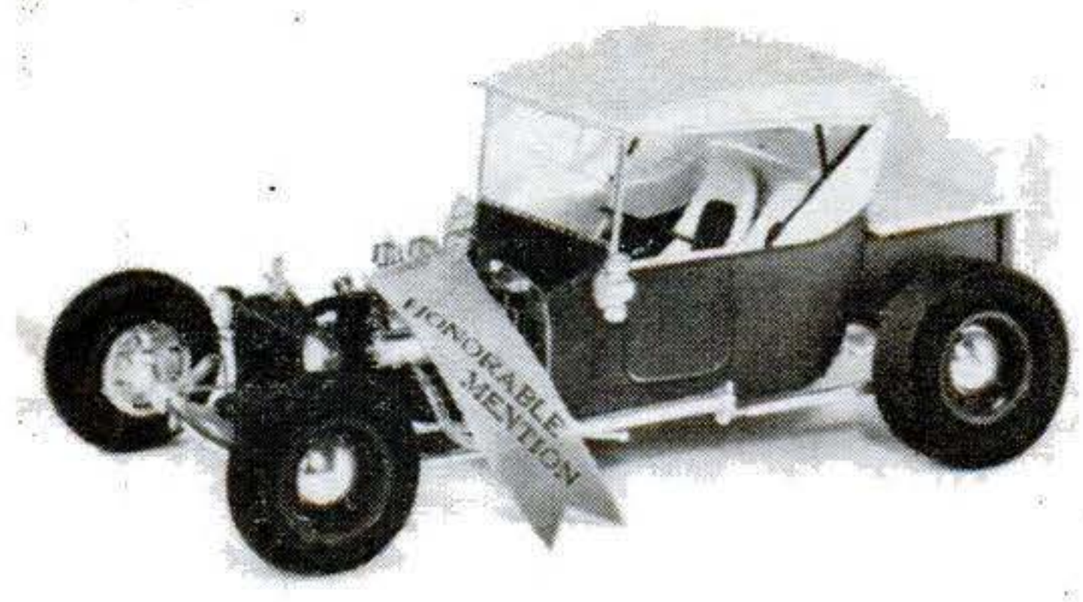

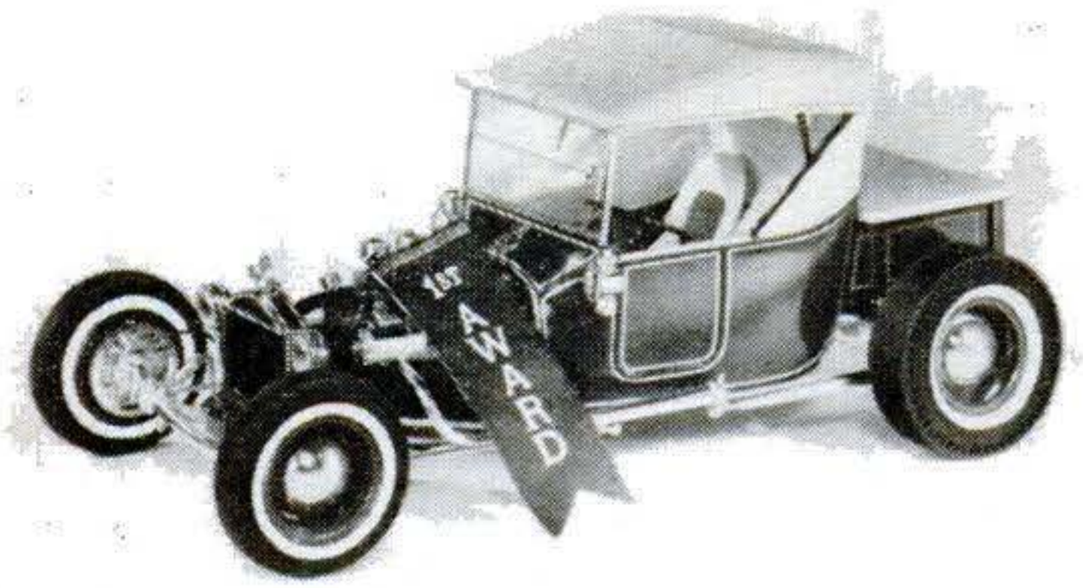

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the lever compulsively, again and again.

As part of a study by James Olds and M. E. Olds of the University of Michigan, supported by a grant from the U.S. Atomic Energy Commission, the rat—along with others like him—has been trained to press the lever three times. Rats can easily learn to count up to three, say the researchers. Then he runs through a transparent plastic maze to another lever, seen in the background, where he repeats the same actions.

Purpose of the training is to see what happens when other brain stimuli are combined with the electric current—by means of the electrode, which is hollow. Tranquilizers were injected, for example—and the rat could no longer count up to three.

When a fine gold wire with a radioactive tip was inserted through the electrode, tissues around the electrode were injured and the rat's performance deteriorated. But when the source of radiation was removed, the brain apparently healed itself, because performance was restored within weeks.

Radiation sensations

Can you feel X rays, cosmic rays, and other forms of radiation pass through you? Recent investigation indicates that you probably can.

U.S. Navy researchers discovered that sleeping rats can be awakened by X rays, and other investigators have conditioned rats to press a lever in response to X rays. The rats "felt" the X rays, but did not see them.

Now two Irish scientists, F. J. D'Arcy and N. A. Porter of University College, Dublin, have demonstrated that people can sometimes see cosmic rays.

In a dark room, a Geiger counter was arranged to register cosmic-ray particles passing through a subject's right eye (about once a minute). Clicks from the counter were mixed up with those from another Geiger counter, placed elsewhere in the room. The subject was required to identify the clicks that coincided with cosmic-ray penetration of his eye.

A statistically significant percentage of times, subjects reported a bright point of light as indication of a cosmic-ray hit. The sensation may be due to scintillation of the fluid in the eye, or to direct excitation of the retina. ■ ■

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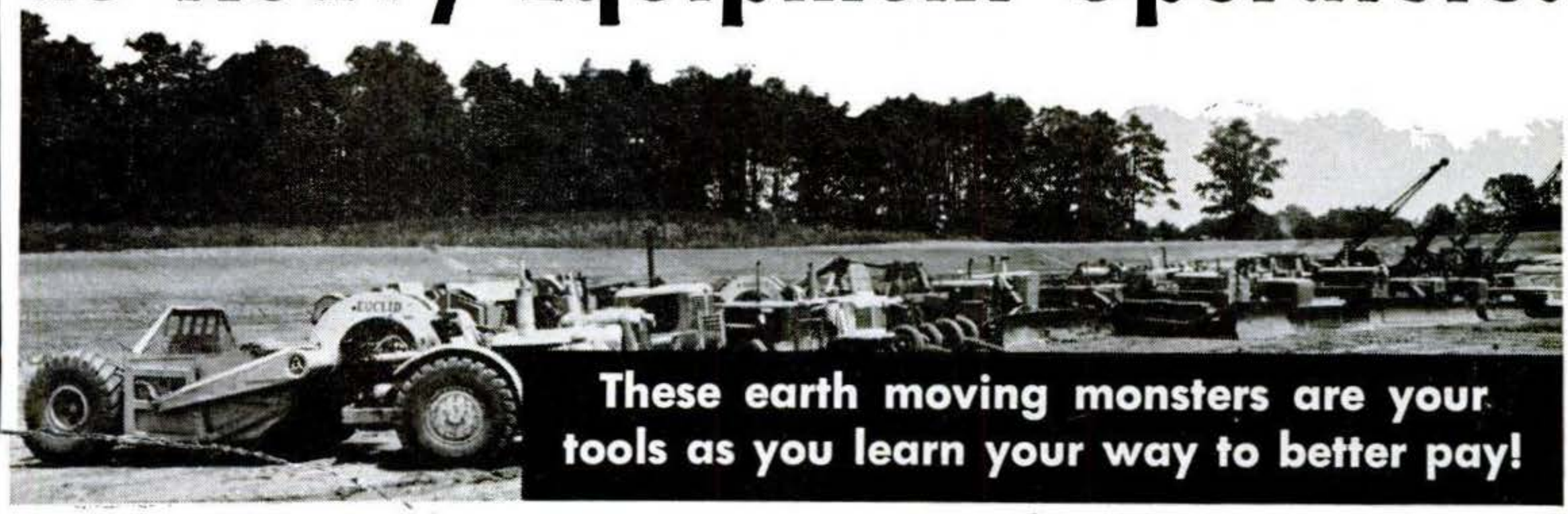

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Jon E. Oppenheim
Great Neck, N. Y.

California graduate reports:
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Paul Van Wettering
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Charles P. Maddox
Ringgold, Va.

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Getting Ahead By Dr. Lewis R. Fibel

A monthly column to help you prepare yourself for a better job

H. L. Misch, vice-president for engineering and research of the Ford Motor Company, adds his voice to the chorus of executives worried about the increasing shortage of engineers. "By 1970," he said recently, "the United States will need more than two million engineers and scientists, or about double the number employed in 1959. If the output of engineering graduates doesn't materially increase, they'll soon be in critically short supply. Engineering graduates will have their pick of the finest jobs offered by industry."

"Is there any place near me where I can study commercial photography? Also, my brother is interested in becoming a television cameraman and would like to know if he can study this near home."—B.B., Brevard, N.C.

The University of North Carolina (Chapel Hill) has a department of radio, TV, and motion pictures. Both you and your brother might find exactly what you're looking for there. Otherwise the schools where you can study commercial photography are rather far from home. For example, there are some junior colleges in California, Massachusetts, New York, Texas, and Wisconsin (listed in American Junior Colleges, 1960, fifth edition, published by the American Council of Education). The situation for TV-camera operation is much the same.

"Am I too old (56) to enter the engineering field, probably in the electrical category?"—C.S., Arlington, Va.

I would hesitate to suggest a full-time engineering curriculum to someone of your age. Instead, you might consider a shorter course of study leading to a career as an electrical technician, for example. The following institutions offer courses that may be of interest to you:

Norfolk Division, Virginia State College, Norfolk, Va.

Catonsville (Md.) Community College

Capitol Radio Institute, 3224 16th St. NW, Washington 10, D.C.

"Could you send me the names and addresses of schools that teach a resident course in watchmaking?"—R.M., Albany, Ga.

Here are four:

Bradley University, School of Horology, Peoria 5, Ill.

Elgin Watchmakers College, 267 S. Grove Ave., Elgin, Ill.

Foegler Institute of Watchmaking, 31-39 E. Fourth St., Cincinnati.

Milwaukee Vocational School, 1015 W. Sixth St., Milwaukee.

"I am 15 and I want to be an archaeologist. Could you give me some information on how to become one?" —W.W., Helowna, British Columbia.

To enter this field, you will need to study as far as the doctoral level. The Smithsonian Institution (Washington 25, D.C.) has prepared a pamphlet, *Archaeology as a Career*, which you can obtain for 25 cents.

"I am about to enter college and would like to know the steps you take in becoming a chemist, and then in working up to becoming a research chemist."—J.A., Montreal, Canada.

If you go to college and earn a bachelor's degree with a major in chemistry, you can call yourself a chemist. The American Chemical Society (1155 16th Street NW, Washington 6, D.C.) has a list of colleges it has accredited for chemistry courses. It also has some good vocational-guidance literature in this

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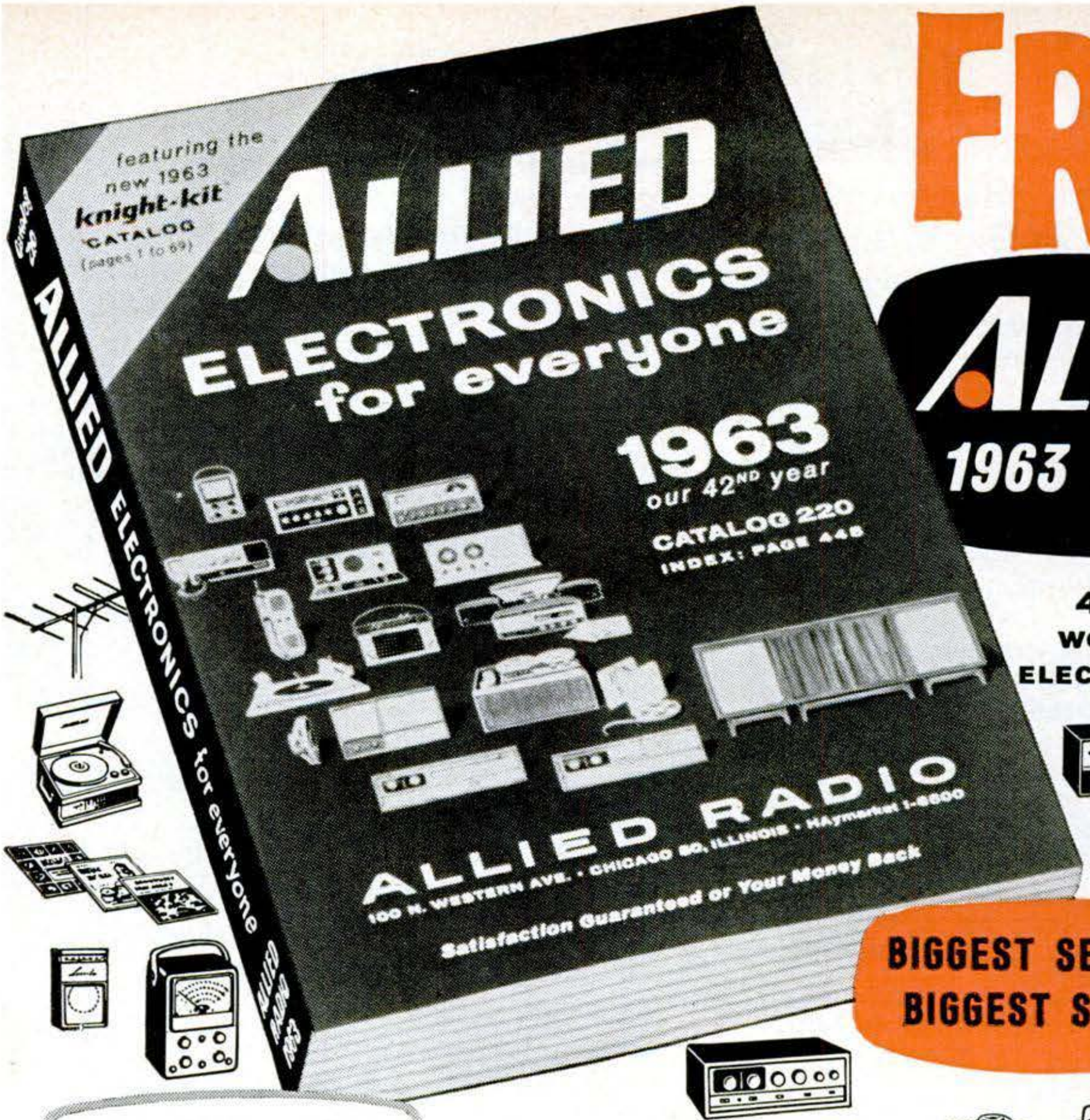

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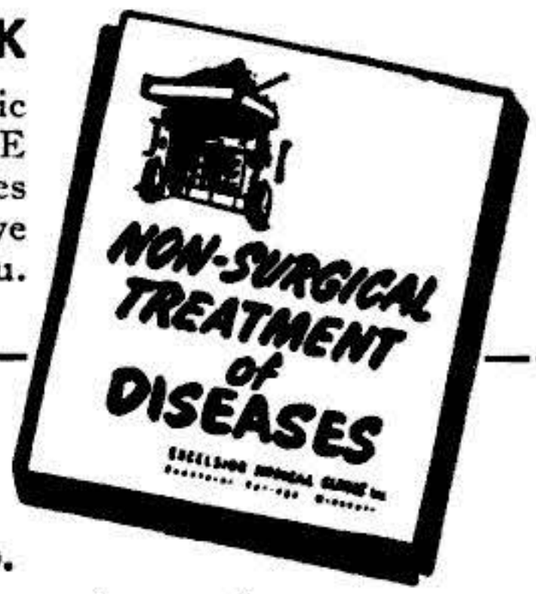

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field. To go far in research chemistry, you will need a minimum of a master's degree, and probably a doctorate.

"I am interested in electrical-engineering drafting. Can I get the training needed to qualify me for a job through a correspondence course? What's the starting pay and how high does it go?"—B.Q., Faribault, Minn.

Drafting can be studied profitably by correspondence through:

American School, Drexel Ave. at 58th St., Chicago 36.

Chicago Technical College, 2000 S. Michigan Ave., Chicago 16.

International Correspondence Schools, Scranton 15, Pa.

LaSalle Extension University, 417 South Dearborn St., Chicago 5.

Lincoln Extension Institute, 1401 W. 75th St., Cleveland 2.

I would advise that you first learn the essential skills of drafting, and later specialize in its applications to electrical engineering.

Recent U.S. government figures show average weekly earnings of $72 for tracers and $90 for junior draftsmen in metropolitan areas, $120 for senior draftsmen, and $146 for lead draftsmen.

"I am interested in business-machine repair. Can you suggest schools?"—P.D., Pismo Beach, Calif.

Business-machine manufacturers in many cases offer on-the-job courses for new personnel. Special courses are also available at Oakland (Calif.) City College and Oregon Technical Institute (Klamath Falls).

Typewriter repair may be studied by correspondence from the Technical Home Study Schools, 150 Park Ave., East Rutherford, N.J. (accredited by the National Home Study Council), and at some trade schools.

• •

Send your questions on careers and technical training to:

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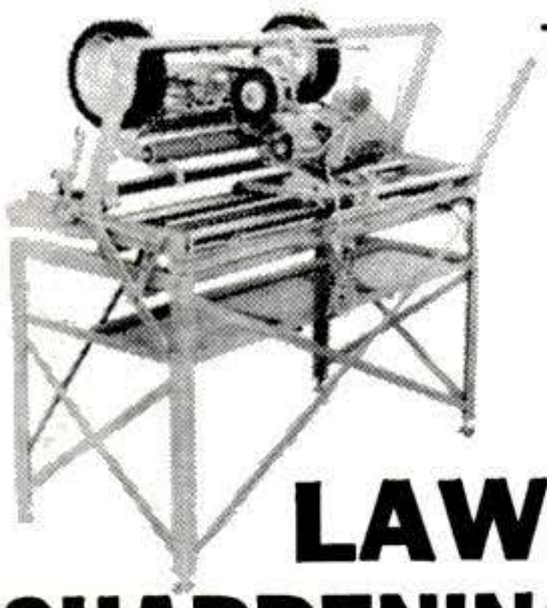

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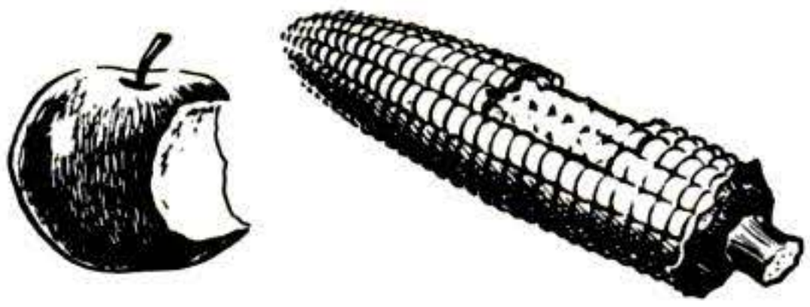

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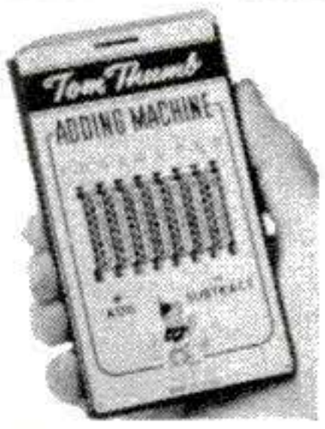

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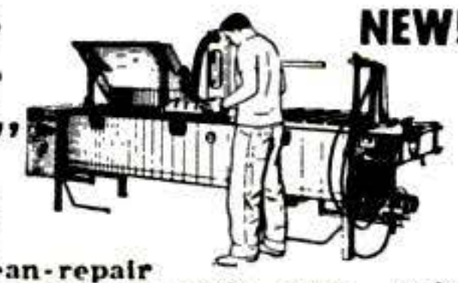

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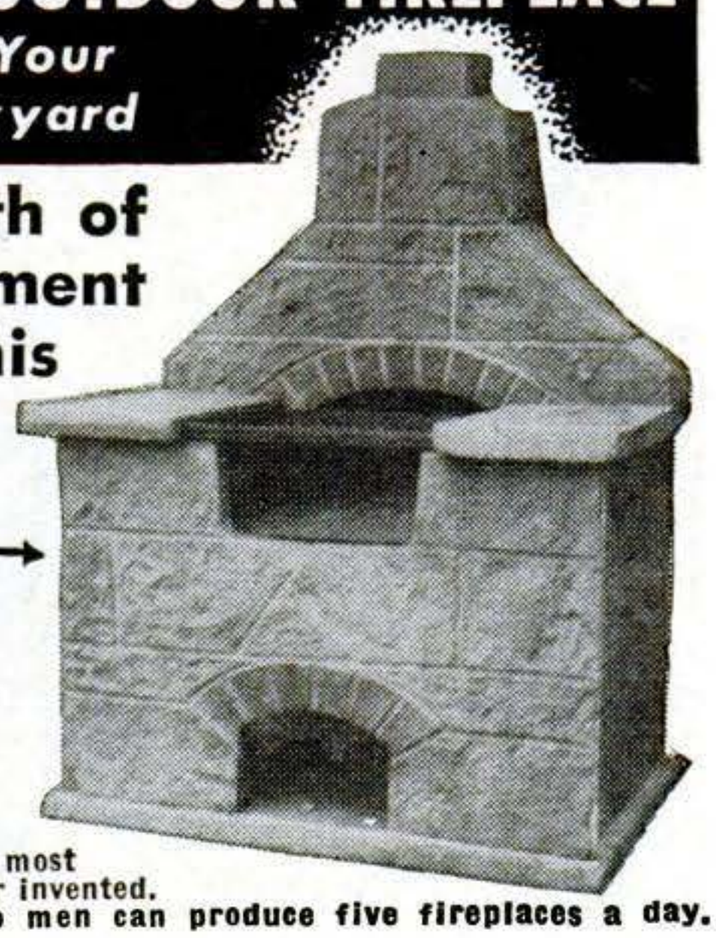

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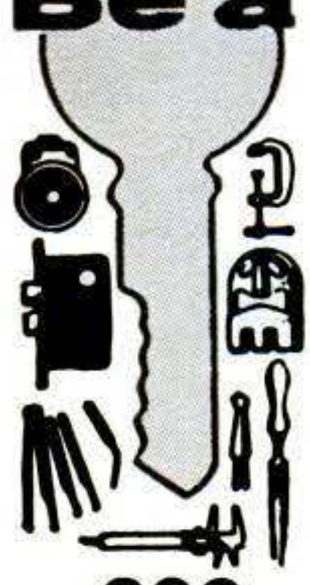

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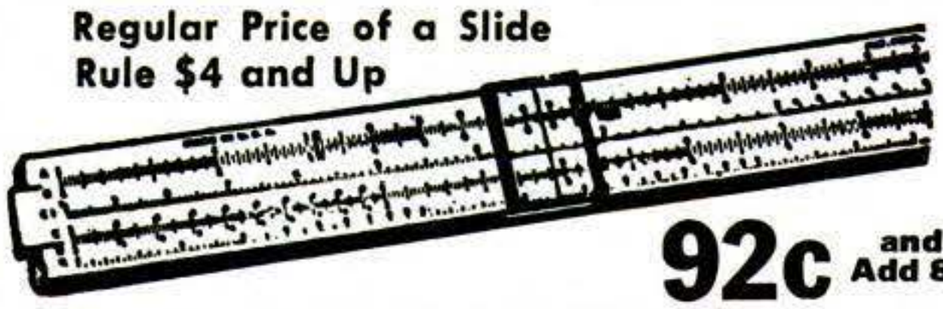

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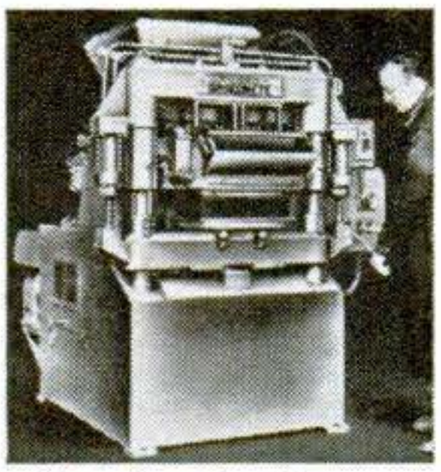

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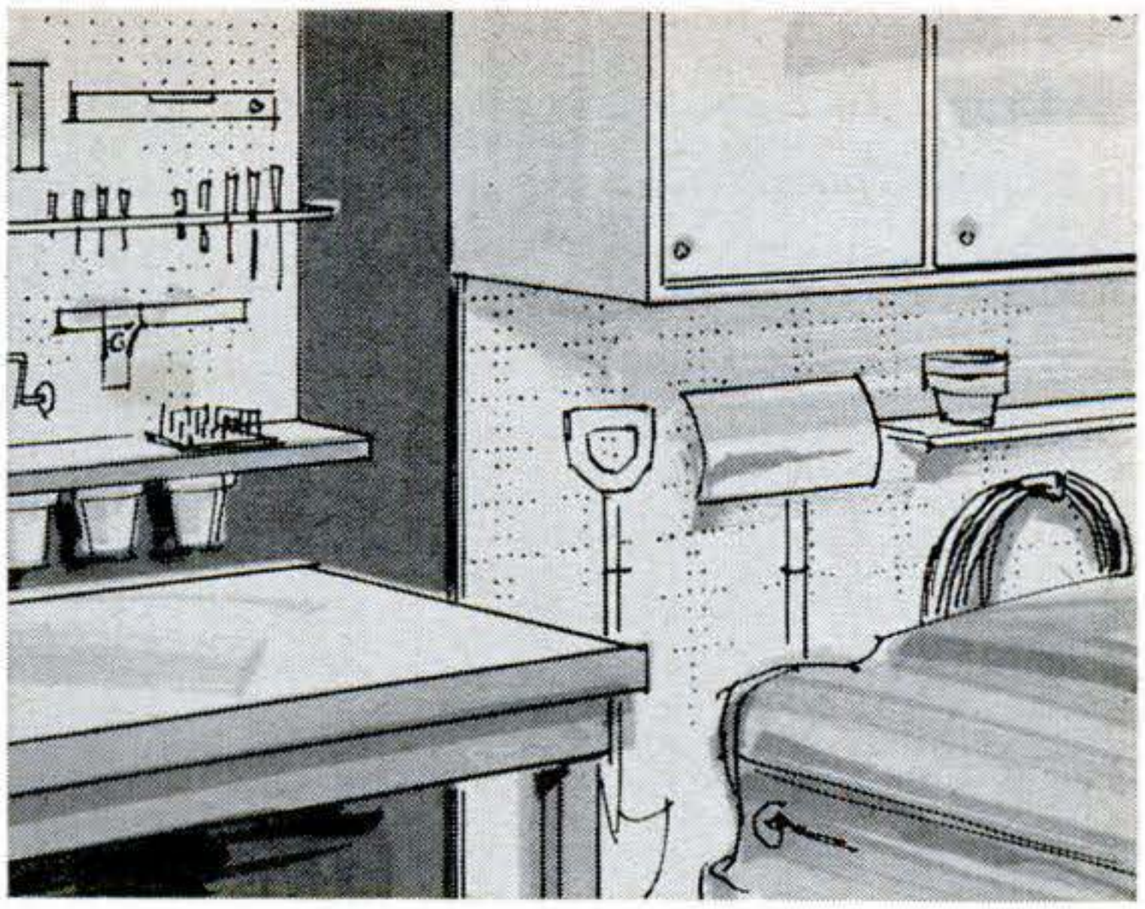

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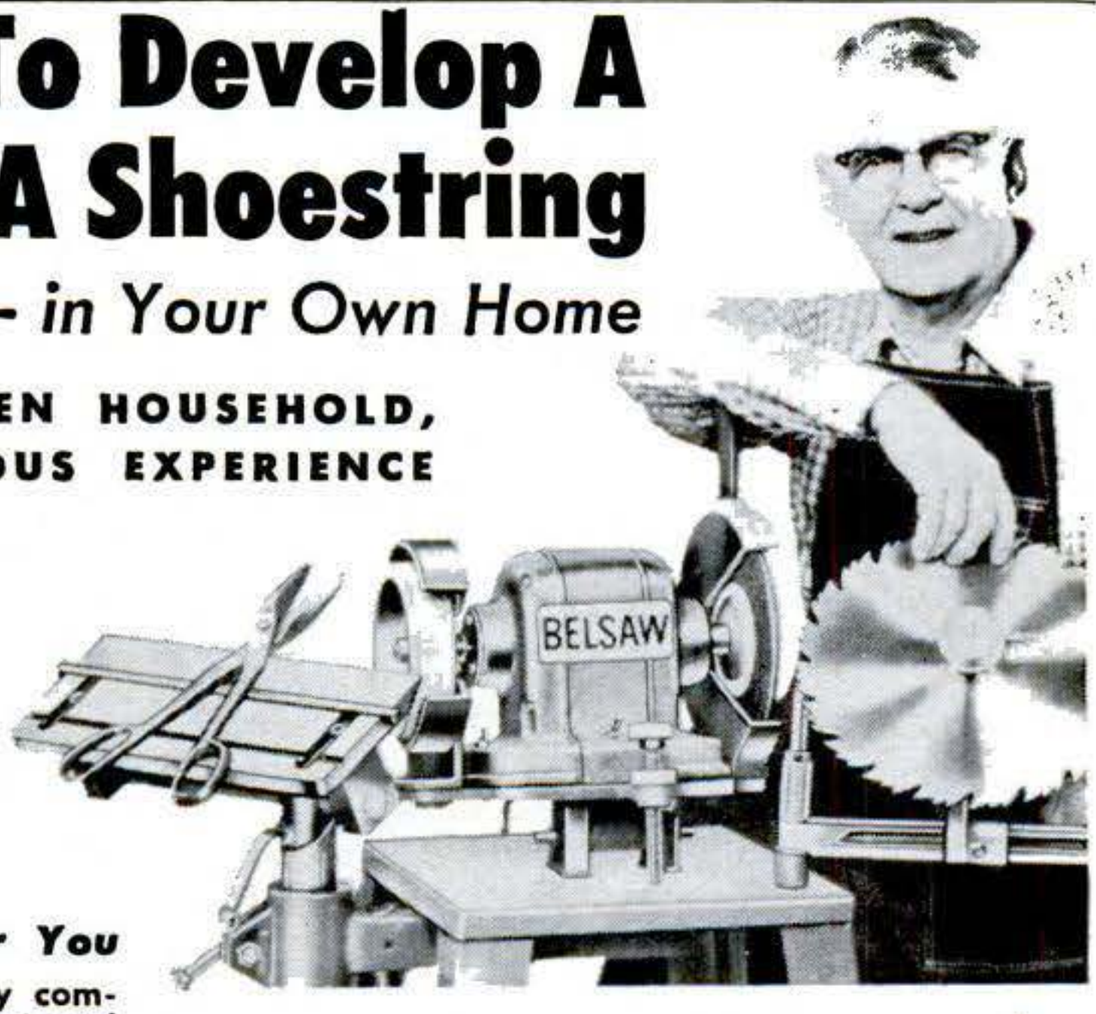

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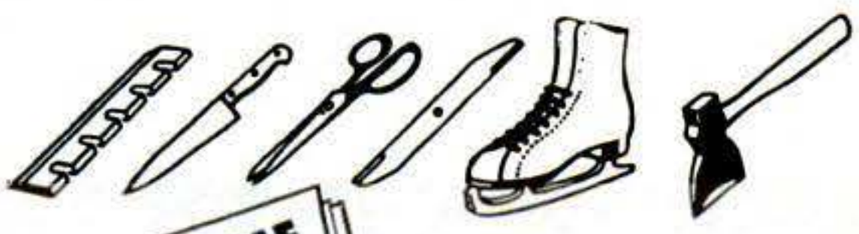

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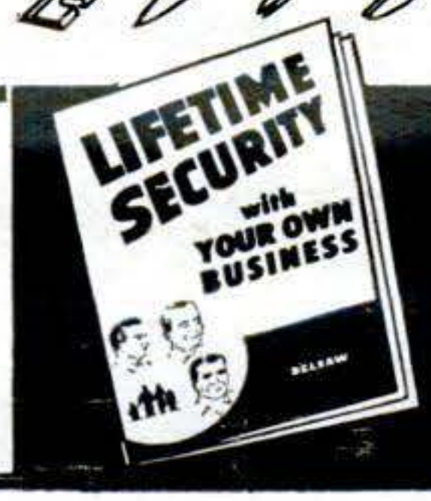

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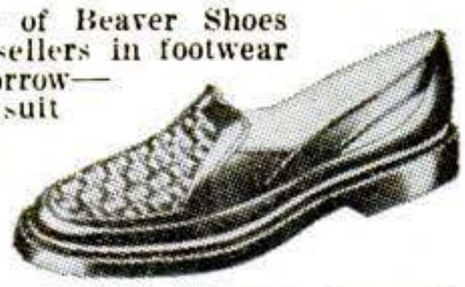

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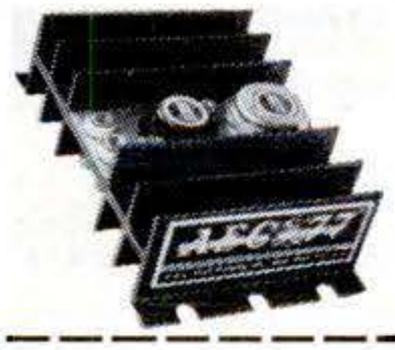

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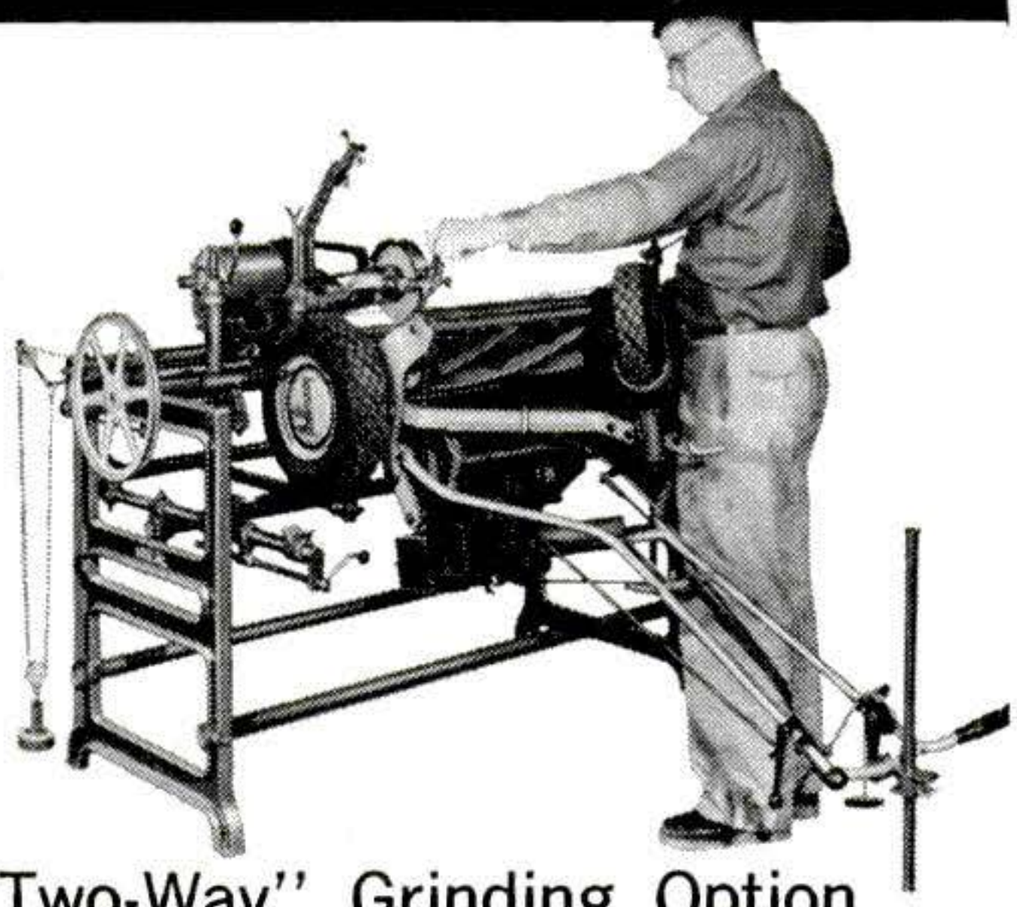

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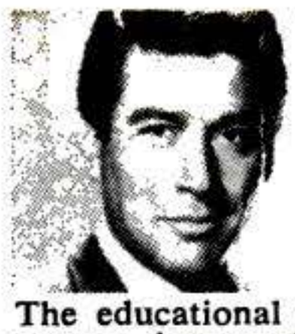

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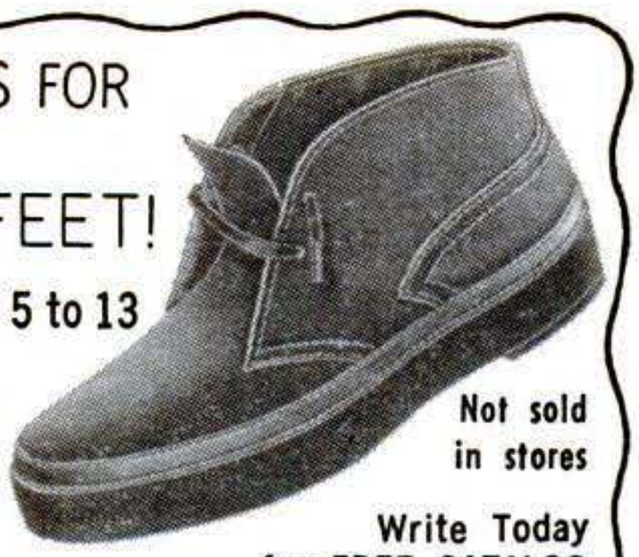

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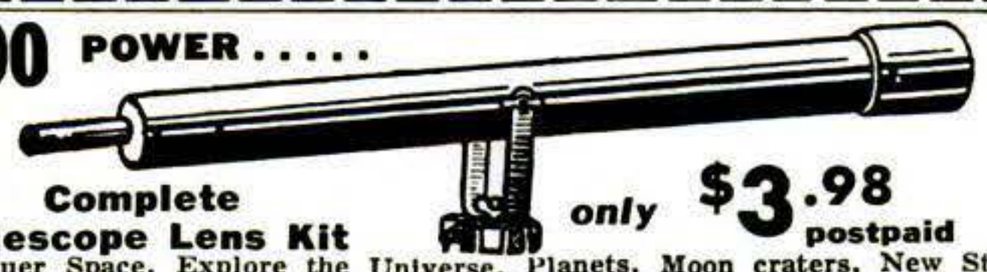

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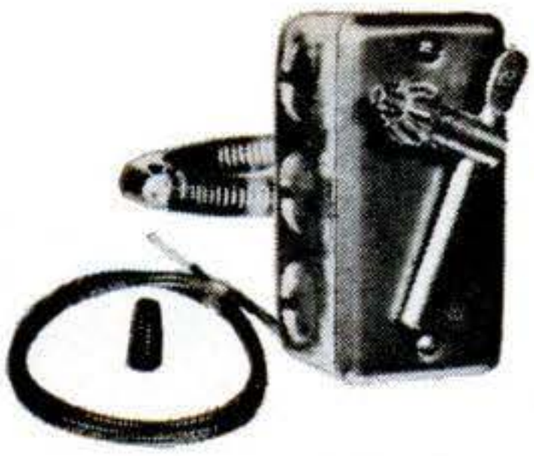

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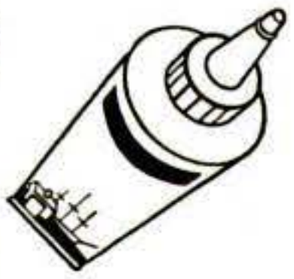

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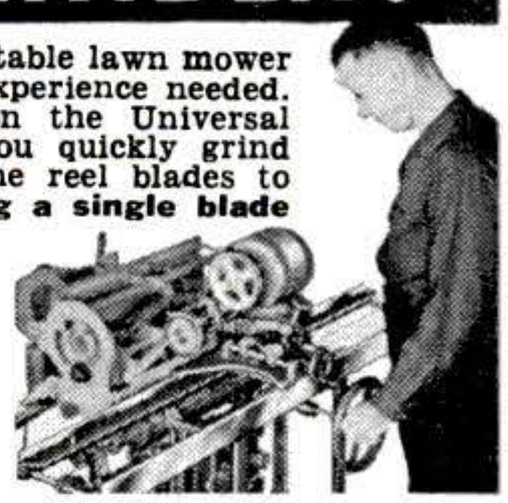

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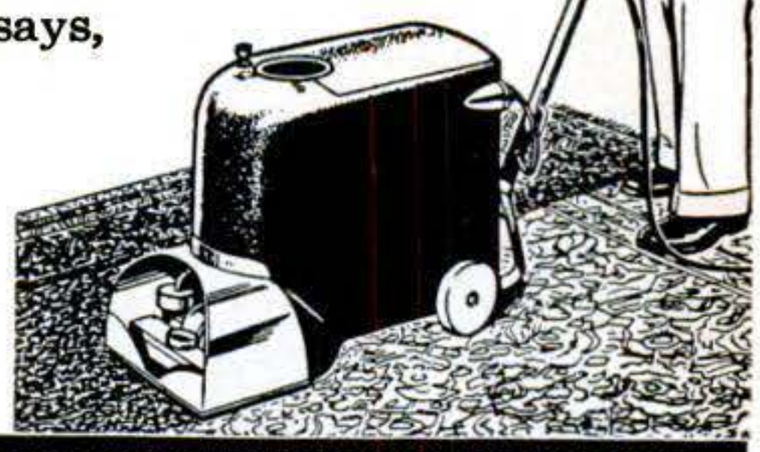

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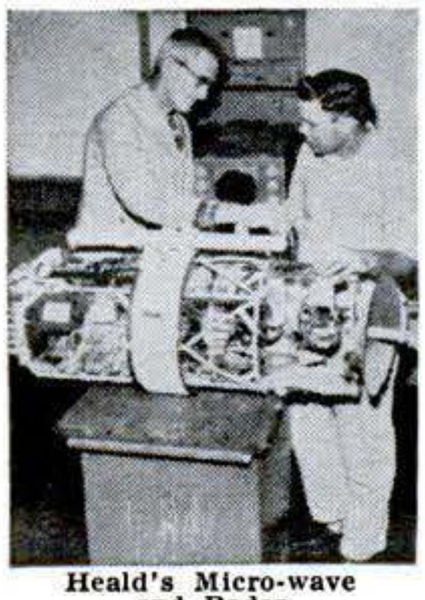

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Detroit report

By Devon Francis

Smoother ride with nylon

Before autumn you'll probably be getting nylon tires without that morning thump. Biggest objection to tires with nylon cord—despite their toughness and all-around wearability—has been their tendency to develop a flat spot after standing. The flat spot does, of course, disappear after a few miles.

Now DuPont has developed a nylon that won't stretch on standing. That's what has been causing the out-of-roundness in tires made with nylon cord.

The prospect: nylon-cord tires installed on cars as original equipment.

Fail-safe crankcase ventilation

Ford engines will have a true built-in crankcase-emission purifier in a year or two. Pipes *inside* the engine block and heads will carry blowby to the air cleaner. A self-cleaning feature will eliminate periodic maintenance.

Tricks with glass

American Motors is showing great interest in the Corning bendable glass [see Feb. "Detroit Report"]. Their ⅜-size model has windows that bend right into the roof, making entry and exit easier.

Studebaker is also looking into the product for possible use in their Wagonaire sliding-top station wagon. A one-piece glass top would slide across the roof and down the back of the car. The big problem: cost.

Other futuristic glass treatments are being tried by Ford Motor Co. One experimental station wagon has roll-up glass slats on its top, and sides that can be raised and lowered like the cover of an old-fashioned roll-top desk.

Another experimental Ford wagon has jalousies that crank open. But engineers are still trying to get satisfactory sealing with this arrangement.

More immediate and practical is Ford's decision to install some of its windshields with adhesive calking. This is the same material that GM has been working slowly into its production.

SAAB gets an oiling system

For fans of the Swedish SAAB, there's news. The 1963 Granturismo model has a separate oiling system—no more mixing lubricant with fuel. A separate tank, holding oil for 1,000 to 1,200 miles of driving, is mounted on the left side of the engine. (Of course, as in all two-cycle engines, the oil is consumed in the combustion process.)

A gauge on the tank shows the oil level, and a warning light on the instrument panel signals a failure of oil flow. A crankshaft-driven pump forces the lubricant through ducts in the engine block to the cylinder walls, main bearings, and con rods.

This and that

Transistorized ignitions are coming on strong. The latest to offer them optionally are GMC (GM) trucks . . . Chevy has introduced a conversion kit that gives the owner of a late-model car the convenience of self-adjusting brakes. Kits are available through Chevy dealers for 1959-1962 Chevrolets, 1962 Chevy IIs, and 1960-1962 Corvairs. Biggest advantage: no down-time for brake adjustments . . . Goodyear Tire & Rubber predicts that by 1970 driving a car will be almost like lounging in a rubber ball. Door sides and posts, windshield edging, knobs, handles, and window ledges will be foam-rubbered . . . Think you're driving faster than you were in 1943? You are. A Ford official says average highway speeds have increased 10 miles an hour in two decades . . . Champion Spark Plug finds that cars with 10,000 miles on their plugs have three times more starting trouble than those with new plugs.

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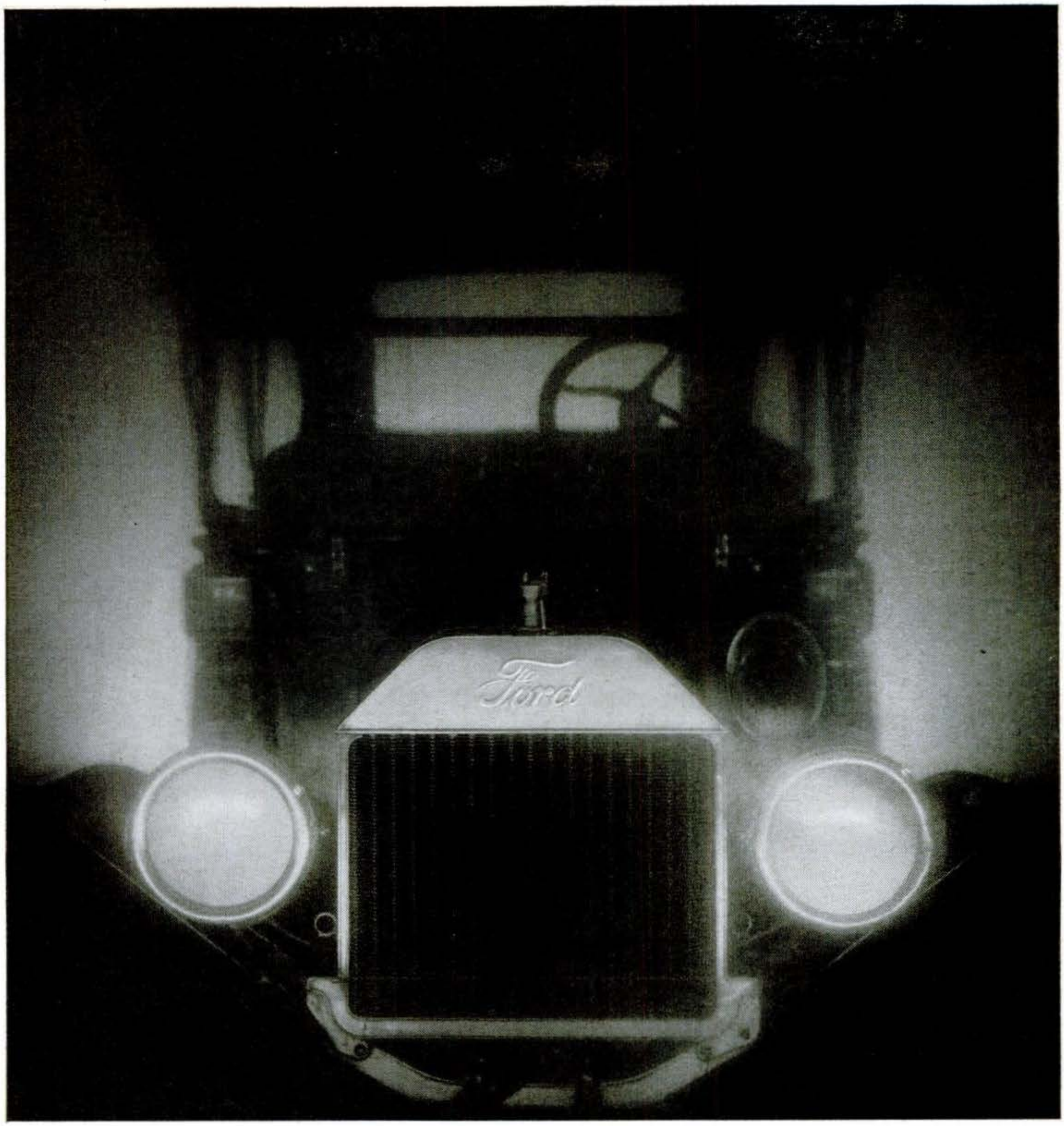

BRAND NEW ECONOMY CAR

THIS 1914 MODEL T FORD GETS BETTER GASOLINE MILEAGE TODAY THAN WHEN IT WAS BUILT. HOW ABOUT YOUR CAR? Forty-eight years ago this Model T got 18 miles to the gallon of gas. Today, thanks to better gasoline, better ignition, it gets 19 miles to the gallon. What's the point? Just this. Almost any car can be an economy car if you'll only give it a little help.

How? Easy. Just drive "Old Faithful" down to see the guy who sells Autolite parts. He's got a whole shelf full of nifty items that will make any moocher a miser in the miles-per-gallon marathon.

Spark plugs that clean themselves while you drive. Factory-quality tune-up parts. Sta-ful Batteries that offer up to three times the protection against dry-out failure. And a friendly way of doing business that is every bit as economical as it is efficient.

You'll find help like this at your nearby garage or service station. Just drive in and tell the man Autolite sent you. He'll know what to do.

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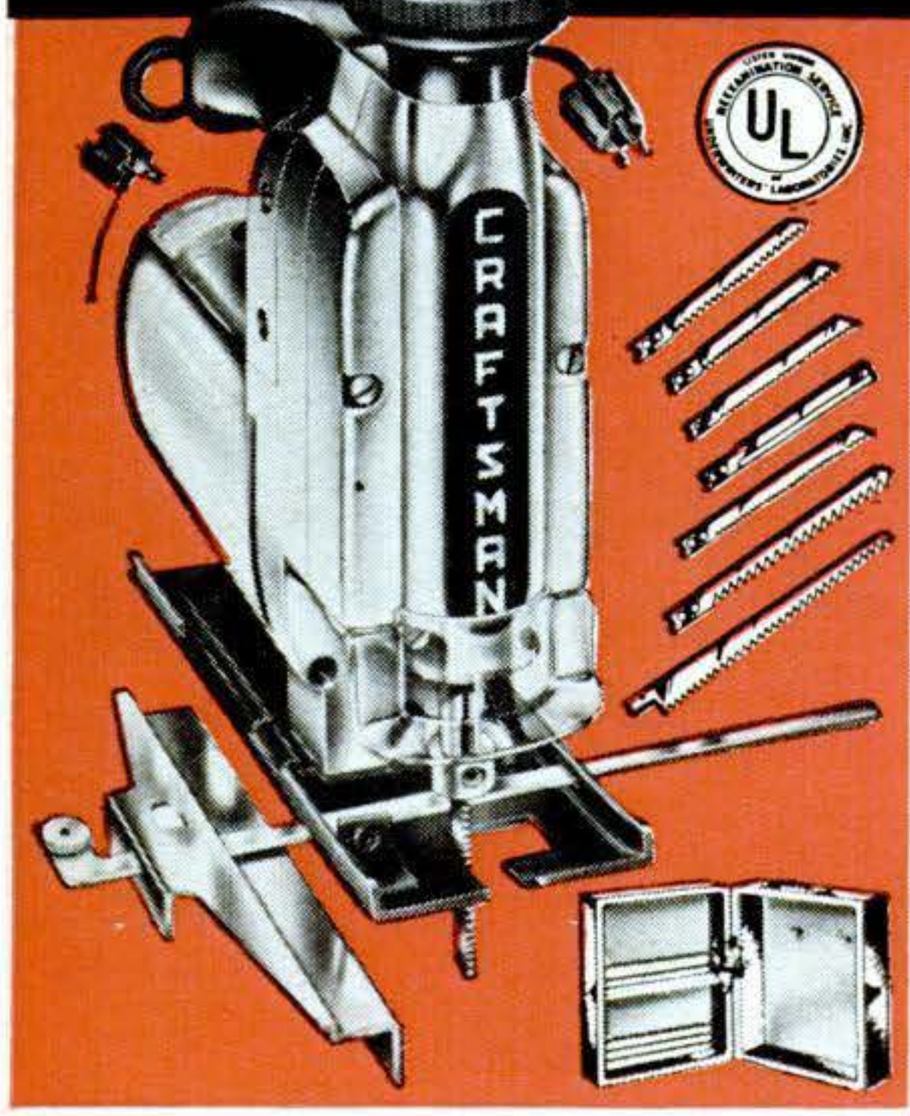

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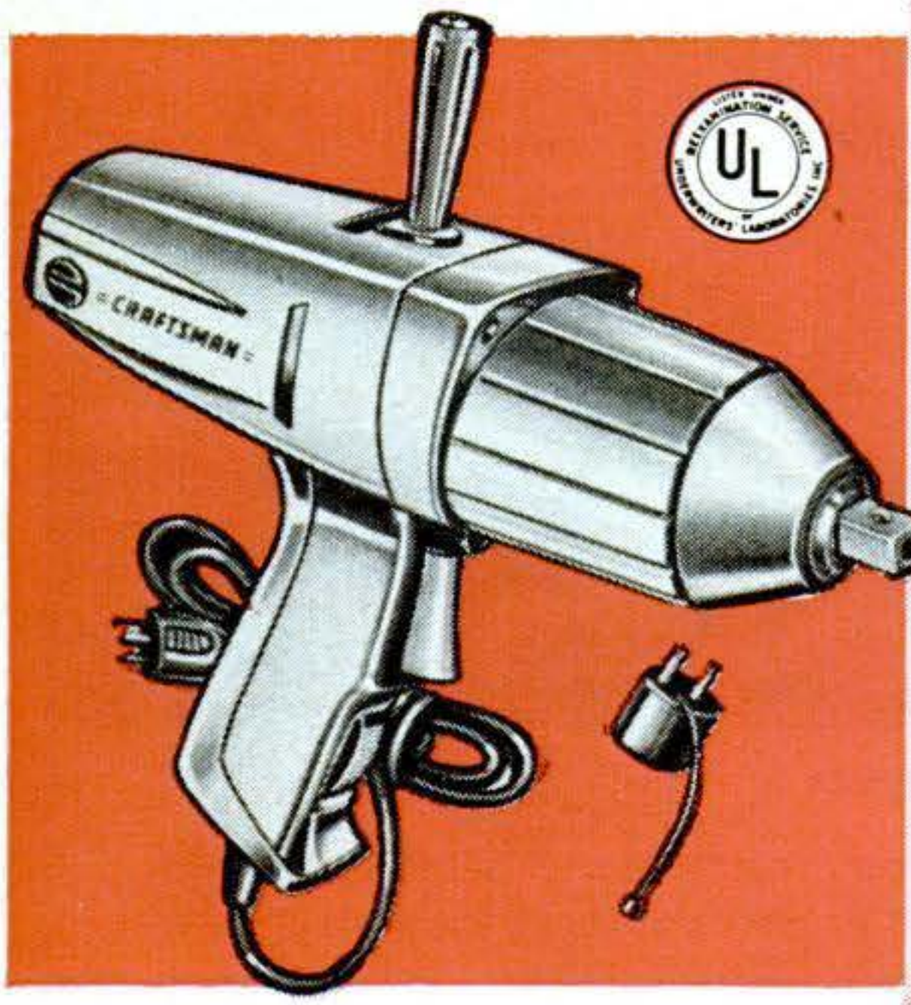

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Develops over 100-ft. lbs. of torque. Drives, removes screws, nuts, bolts, studs. Taps, threads metal. **49.99**

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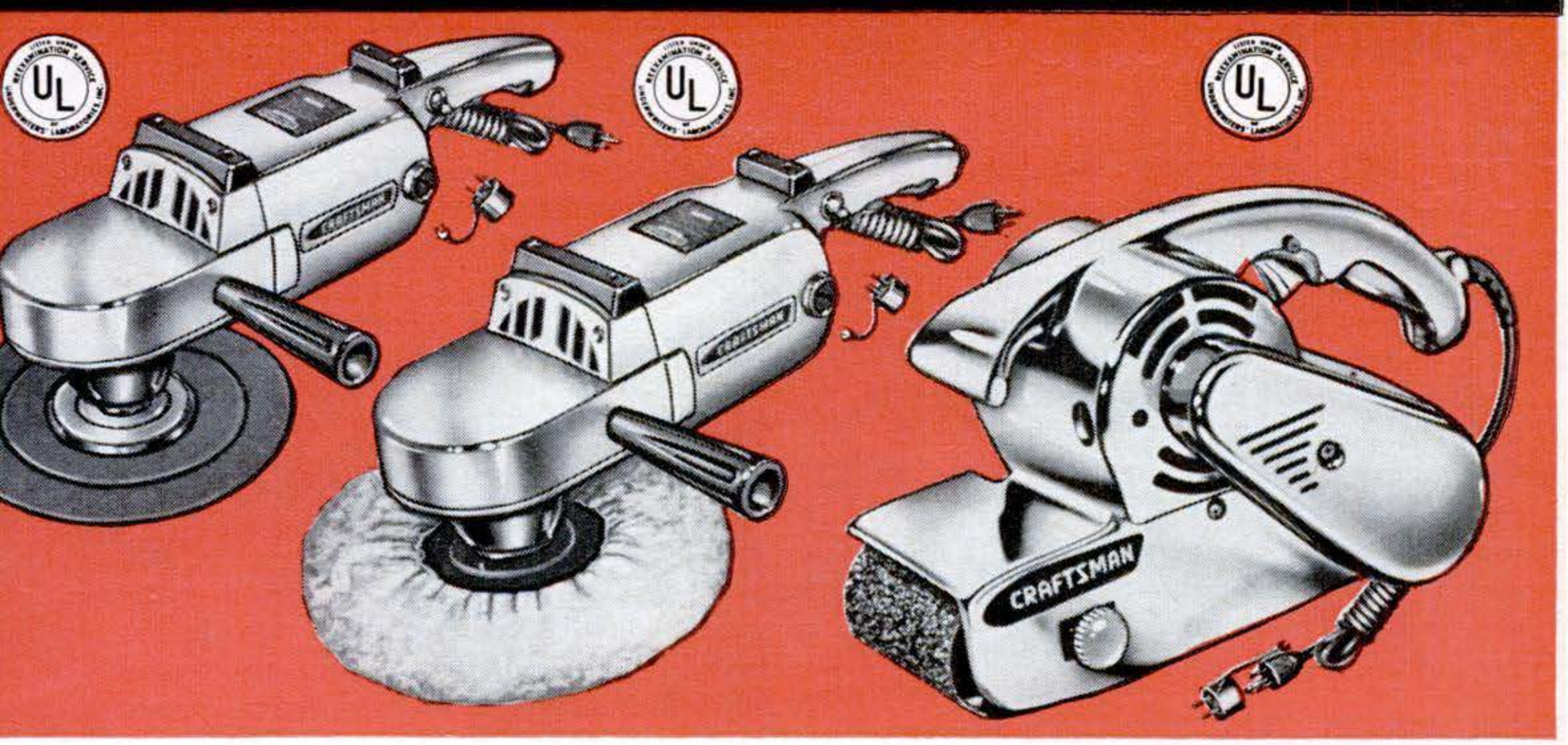

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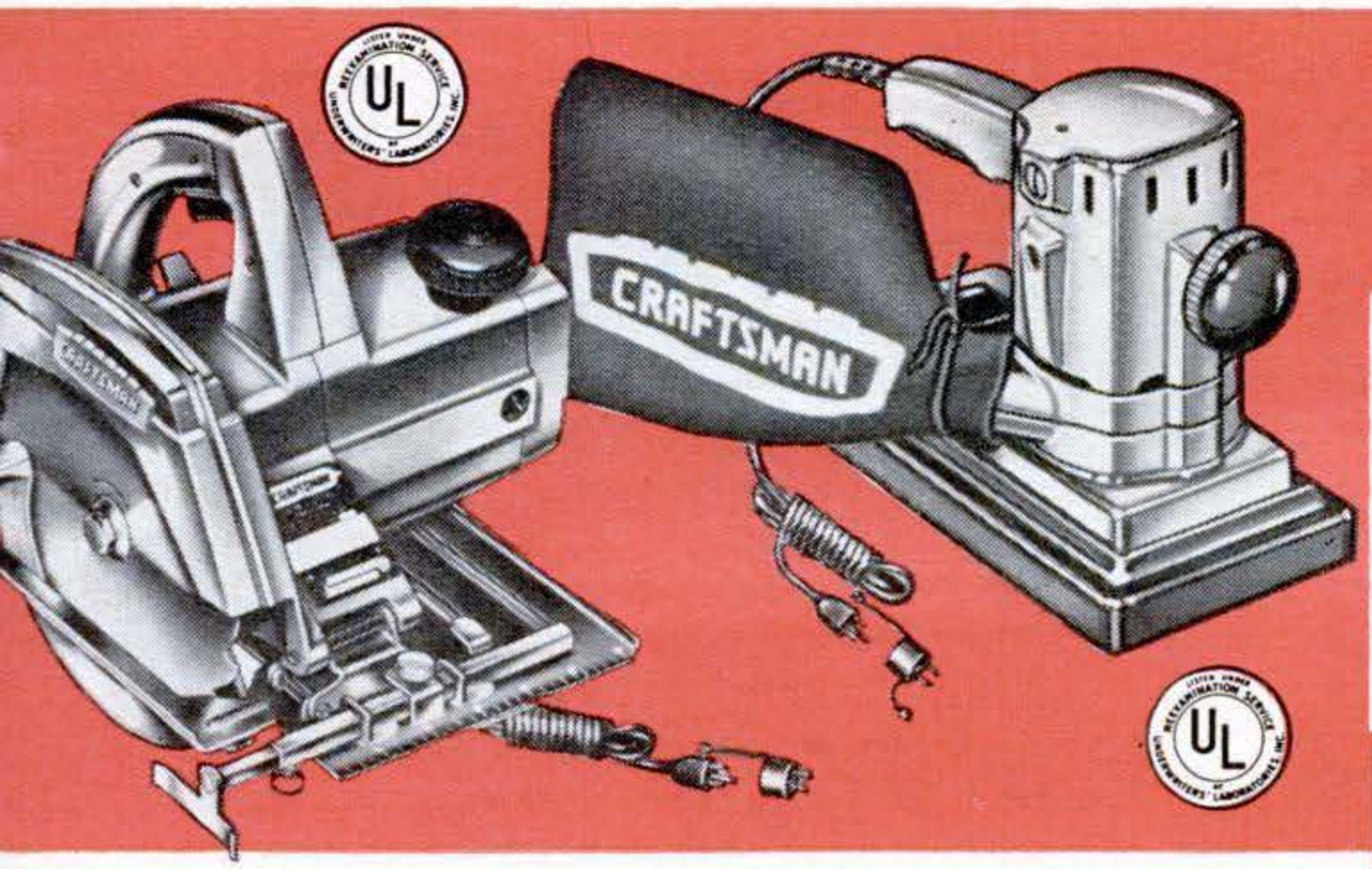
1,400 RPM's puts a fine luster on auto bodies or wood. With rubber pad, lamb's wool bonnet. **49.99**

Regular $64.95, 4-inch Portable Belt Sanders

Goes to job or mounts stationary for small part sanding. Fine, medium, coarse "endless" belts. **49.99**



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Popular Science *90, 60, and 30 years ago...*

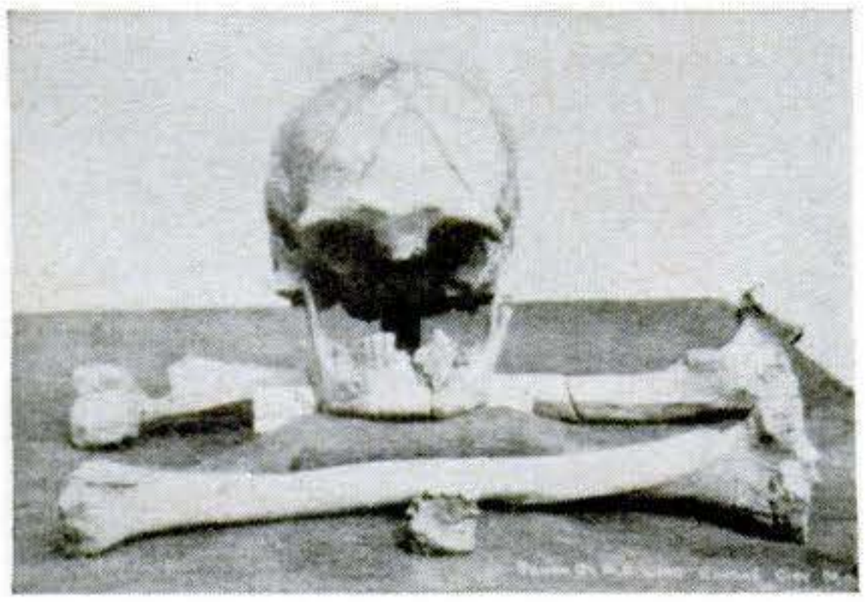
1873 "**Travelers returning from Paris** were loud in their praise of the asphalted roadways of that capital, contrasting the roar of our granite-paved filthy thoroughfares with the smooth, noiseless, cleanly streets of the French capital.

"So soon as we discover native deposits of asphalt we shall avail ourselves of the improvements. The 'coming man' can then go about his affairs without having his ears stunned by the clatter of vehicles; the horse perform his service without risking life and limb; and the carriage roll along without being jolted to pieces."

"**The vibrations of an earthquake** differ in no respect from those produced by other causes, except in intensity. The jar arising from a discharge of artillery, a carriage rolling over pavements, or slamming of heavy doors, puts in motion a series of moving waves just as truly as the rending of rocks, or an explosion of steam or gas in a fracture thus produced."

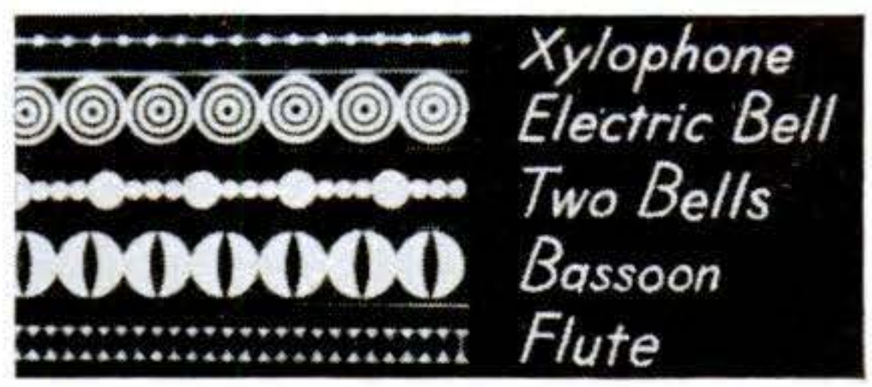
1903 "**While excavating a cave** close by a ravine opening into the Missouri River valley near Lansing, Kansas, a farmer and his sons exhumed a human skeleton. Various opinions are held concerning the age of the remains, but there seems little doubt that they are evidence of the high antiquity of man in America—perhaps dating back 12,000 years ago.

"The skeleton is that of an adult between 40 and 50 in age, about five feet two inches tall, and of slight build; in much probability, a female. The bones were firm and fully fossilized. It seems very probable that the skeleton had been immersed in water while held together by flesh—perhaps death came by drowning—and had then remained in quiet water until it was covered so deeply by soil that it could no longer suffer the vicissitudes of exposure to the atmosphere."



"'**Industrial education,**' says Dr. Lyman Abbott, 'is a function of the state; not because it is the duty of the state to give to every man a training in his profession, but because it is the function of the state to prepare man for self-support. One difficulty with our system of education seems to me to be that we have paid too much attention to higher education and too little to broader education. We need to broaden the base even if we have to trim a little at the top.'"

1933 "**Synthetic music** is being produced in a German film studio by reversing a familiar process. When artists sing and orchestras play before a microphone, their music is recorded as a wavy



black line on the sound track. What would happen if an artist were to draw shapes, imprint them on sound film, and play it back? Technician Oscar Fischinger got startling results. Concentric circles drawn in a strip imitated an electric bell, eye-like spots reproduced a bassoon, and a pattern of dots sounded like a xylophone. Variations in sizes and shapes produced changes in pitch, loudness, and timbre."

"**A new ventilating system for cars** utilizes the air currents set up when a car is in motion. The secret of the system is a special vertically split window. One half of the window is raised and lowered in the usual way, while the other half swings on a pivot to prevent drafts striking the car's occupants."

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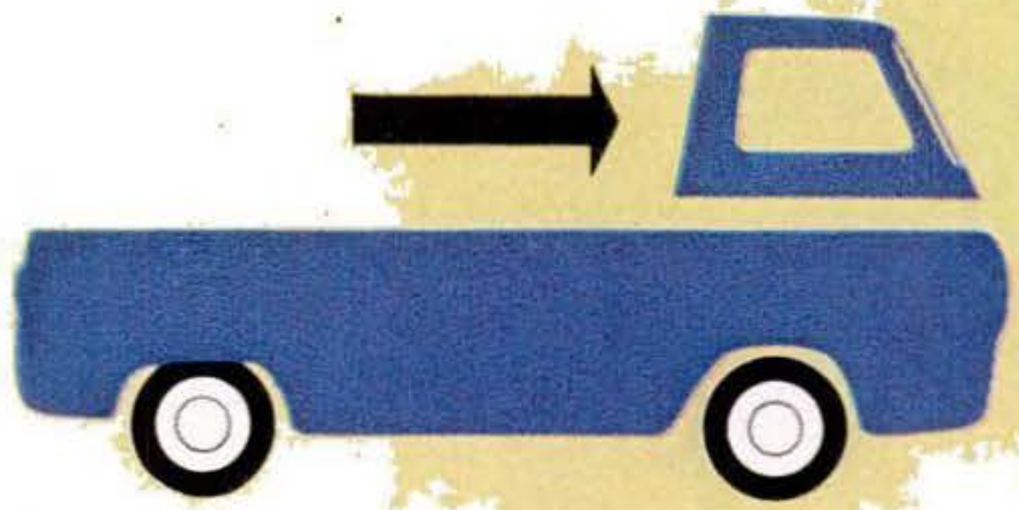
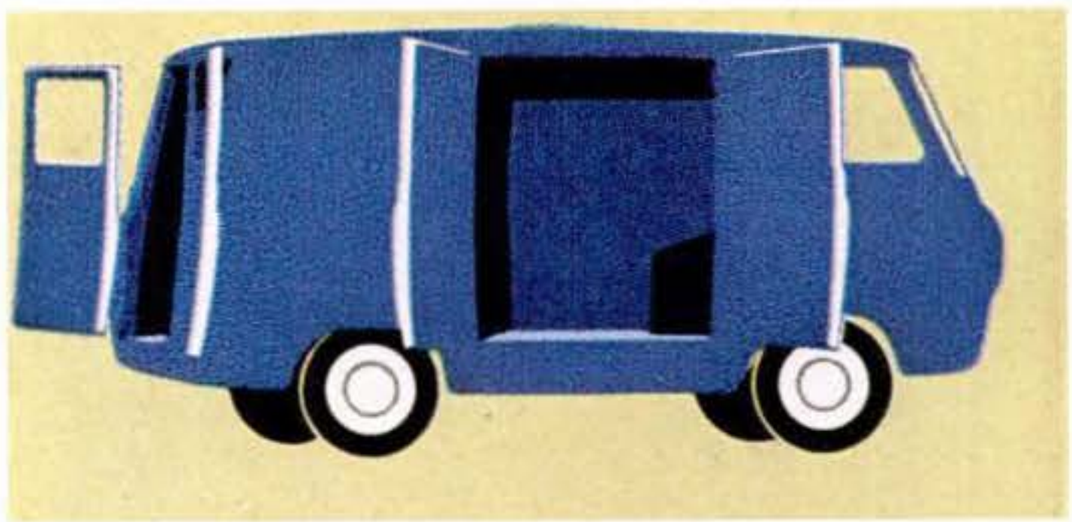
WHAT A PICKUP!

What a pickup you'd have if you could...



move the cab forward so **you could** see the road better **and have** more loadspace...

put a cover on the load area to keep out the weather and prevent theft...



put double doors at the back and side for easy load handling, and...

...keep the cost of all these wonderful improvements below $100.

'63 ECONOLINE offers 204 cu. ft. of protected loadspace; long, low, flat floor; ¾-ton payloads. New options include double doors on left side; windows all around!

You can! An Econoline Van gives pickup owners all these advantages—at a price within $100 of most pickups! And the money Econoline saves on gas and upkeep soon pays for the difference!

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Popular Science Monthly
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Huge windows let car owners watch the 20-minute analysis, which covers 60 different tests.

A new idea in diagnosing automobile ailments may revolutionize the repair business—and make U.S. motorists a lot happier

Here Come the Car Clinics

By Devon Francis

THIS article is addressed to every man who has stood amid the impersonal clamor of a service garage, feeling as welcome as an extra cousin at the reading of a will and trying to explain to a guy in a white smock (with the inevitable clipboard) that the family car is sick and the symptoms are such-and-such.

It's a bad moment in the lives of all motorists. What's the bill going to be? Are they going to

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First Repair Center is on Kings Highway, Cherry Hill, N. J., not far from Philadelphia.

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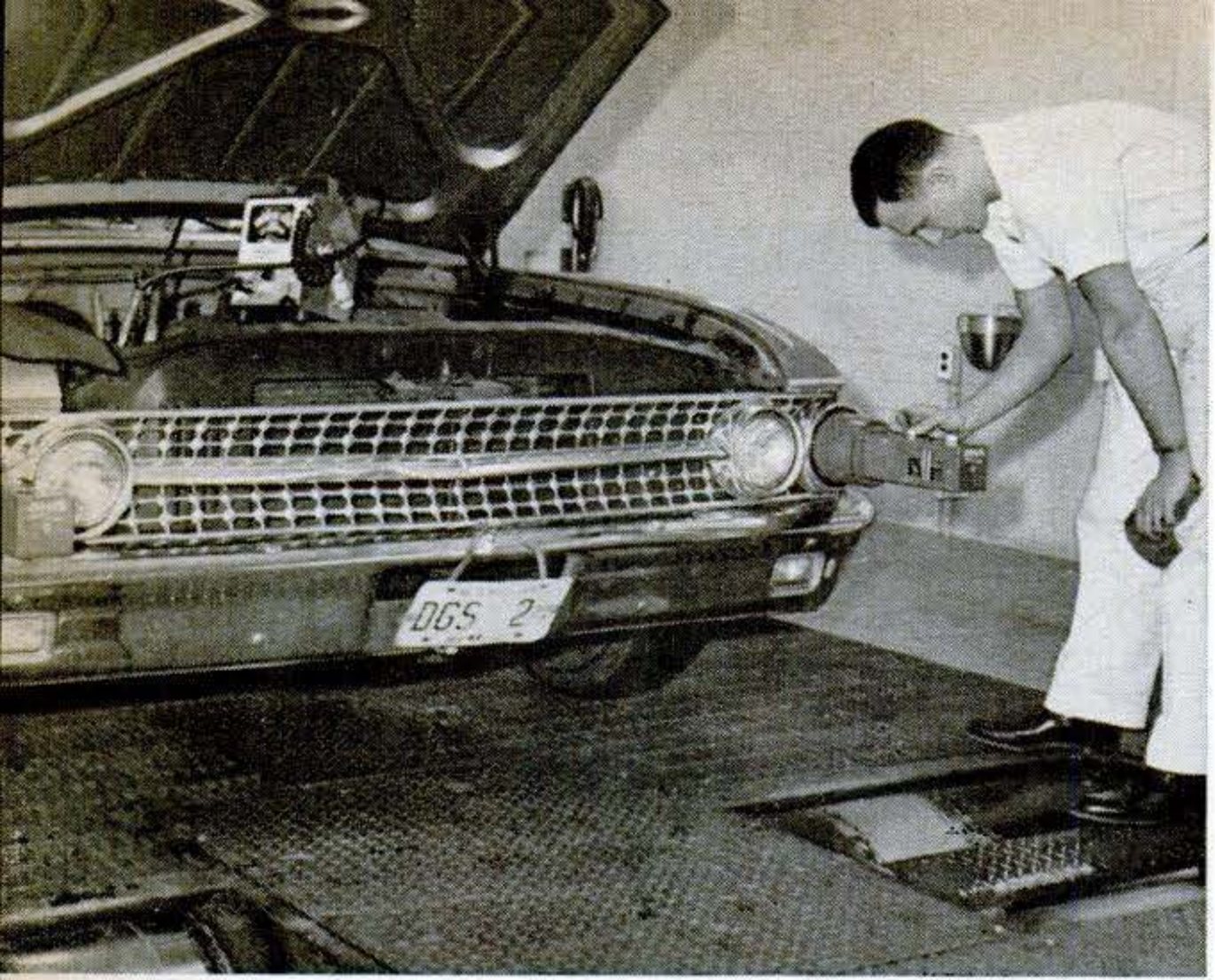

Step by step, here's how the clinic works

1 Car is positioned at point just short of dynamometer rolls for initial examination at Station One (there are three stations in the bay). Headlight adjustment, cooling system, heat valve are checked. Battery is tested for capacity and charge, and cables and terminals examined. Tire condition and pressures, wipers, horn, parking brake are inspected. Fuel and cooling systems and transmission are checked for leaks. An auditory inspection of engine and exhaust system is conducted. The complete bay contains 16 diagnostic instruments.

jack up the air cleaner and build a new car underneath?

Well, I've got news for you. There's a fresh dawn coming in car repair. It still involves a guy in a white smock. He is still armed with a clipboard. But you don't have to tell him any symptoms. You just deposit your car. In 20 minutes you fork over $4.75 and are handed, off the clipboard, a complete diagnosis of your automobile's ailments.

This newest thing in fathoming car illnesses is a sort of automated auto clinic. Nothing like it has existed before. Even now, there is only one of them. But the Mobil Oil Co. (a subsidiary of Socony Mobil), which owns and runs it, is considering the establishment of others. The company operates in 45 states.

This is what makes the operation a clinic: It analyzes and reports. The motorist is under no obligation to have his car repaired by Mobil. Yet, of course, the company does a lot of repair work. Since its Repair Center, as it is called, opened last November, it has had to keep its doors open 16 hours a day to accommodate the customers.

The clinic must be good. Of the hundreds of cars it has fixed, less than one percent have been returned for further repair by unhappy owners—notwithstanding the fact that materials and workmanship are guaranteed for 90 days or 4,000 miles.

The first Mobil Repair Center, at Cherry Hill, N. J., combines the biggest assortment of analytical instruments for probing the malignancies of a car's mechanical and electrical innards ever assembled under one roof.

Getting poor gas mileage? The analysis room will report to you after test that your air-fuel mixture is too rich, or your accelerator pump is faulty, or your automatic choke is sticking, or your plugs are kaput or distributor points parboiled, or your automatic box is upshifting too late, or your left rear brake is dragging.

Mobil does this with an assembly of test apparatus that is recognizable to an expert mechanic, although some of it will not be found in one service garage in a hundred. The Repair Center's chassis dynamometer (essentially, a means of measuring the power delivered by the engine to the driving wheels of a car) is a case in point. Instrument readings can be taken while all a car's components are, in effect, under road load.

The Repair Center has other items more readily recognizable by the car owner. There is a wheel-alignment tester, a recording oscillograph for transmission performance, and an oscilloscope-type ignition analyzer.

There is the customary timing light, voltmeter, ammeter, vacuum gauge, pressure gauge, and fuel flowmeter. A valuable addition by Mobil: a transmis-

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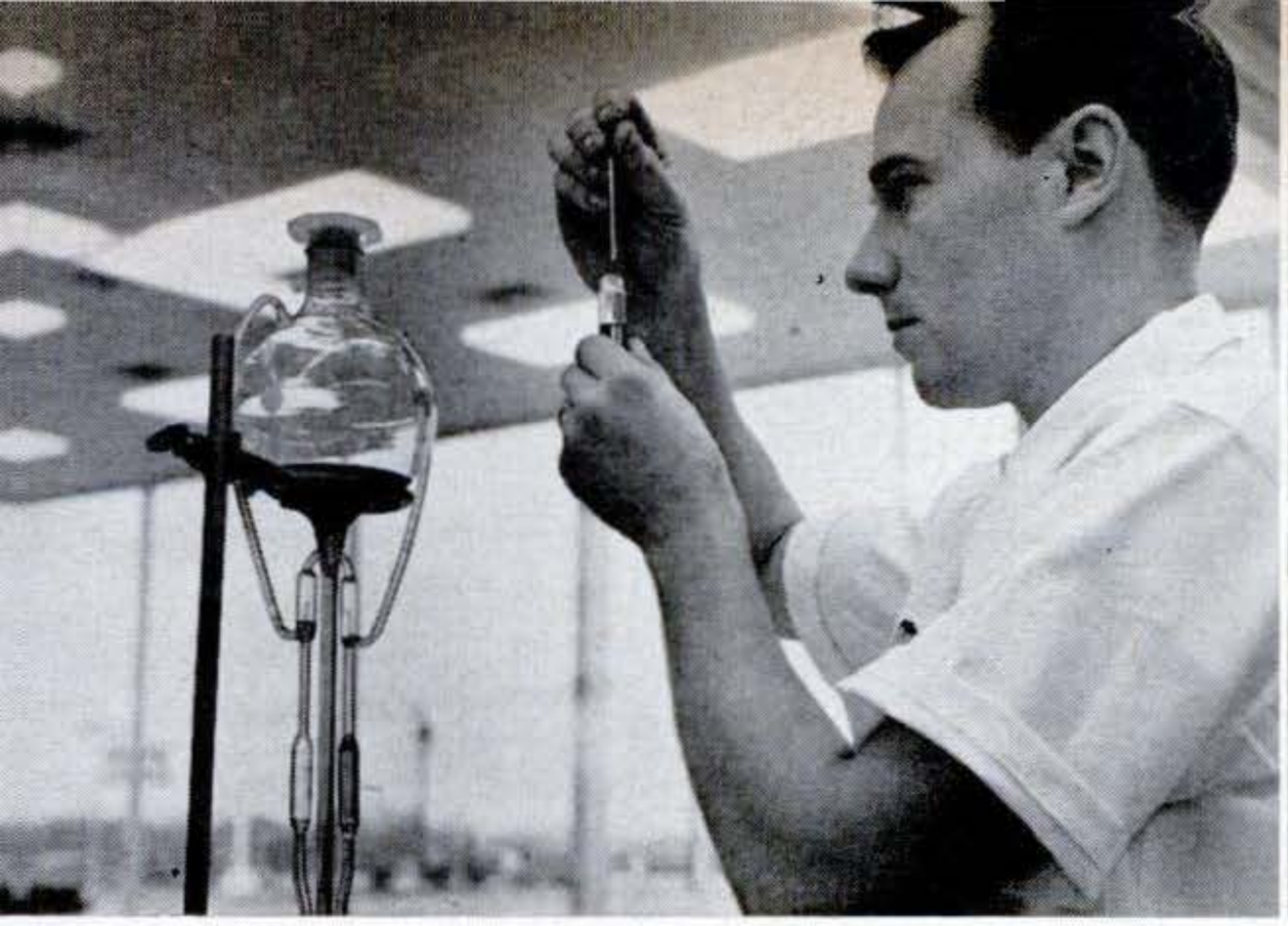
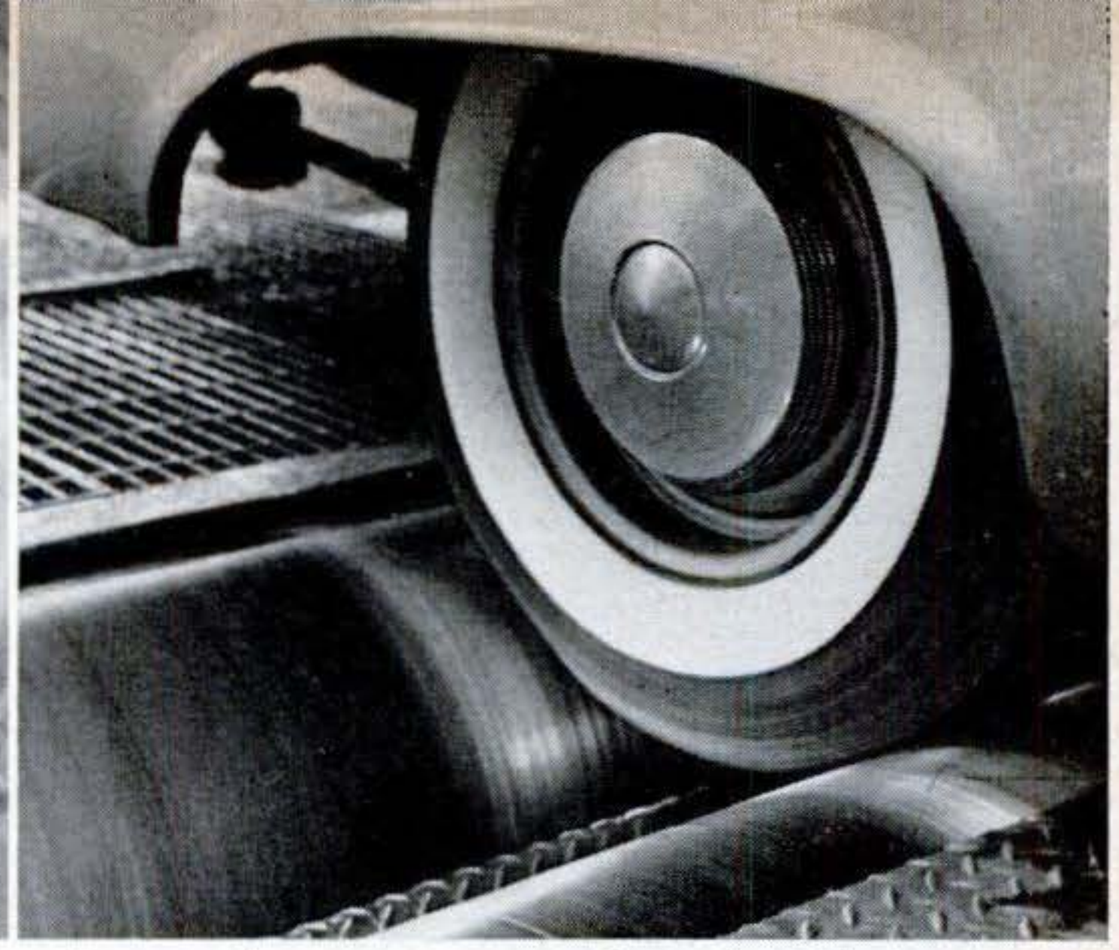
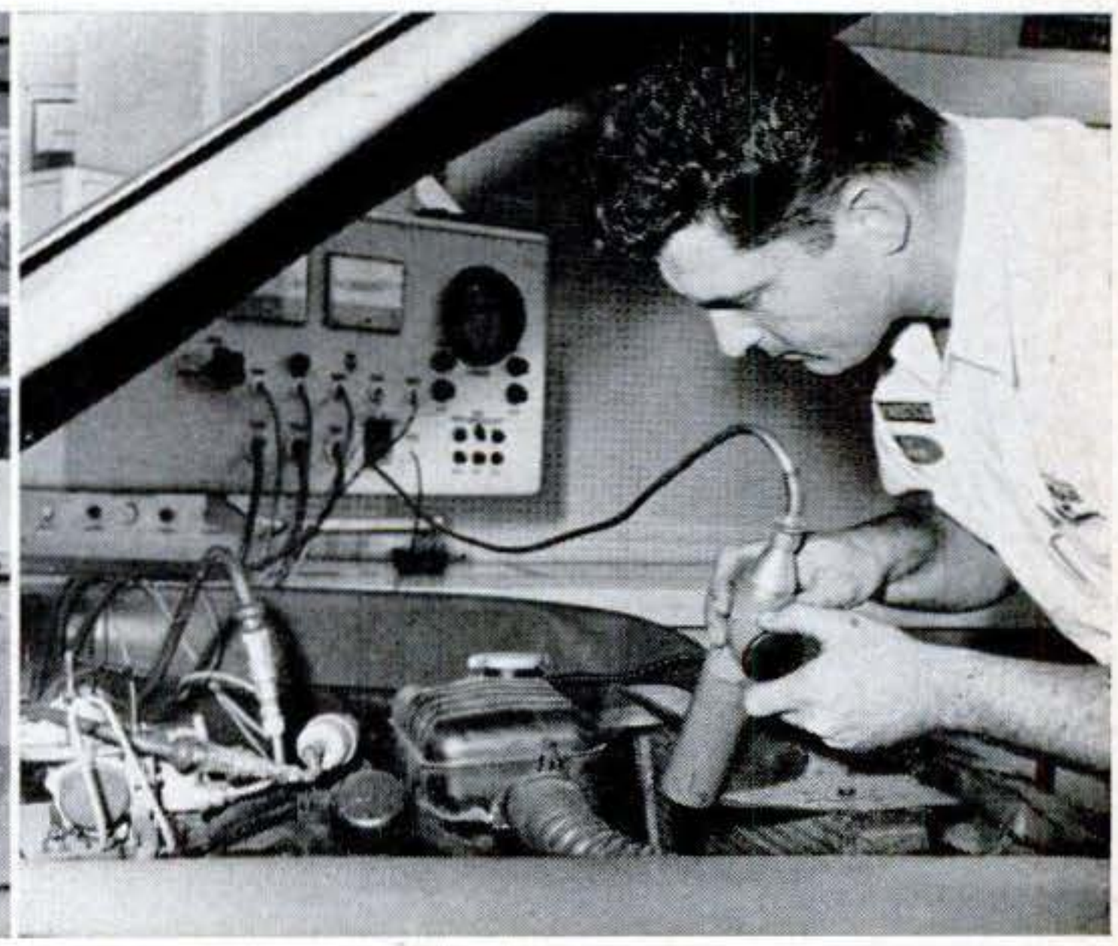


2 Chemical analysis of automatic-transmission fluid is made. High acidity reading indicates need for change. Various tests are monitored by no less than 36 calibrated meters.



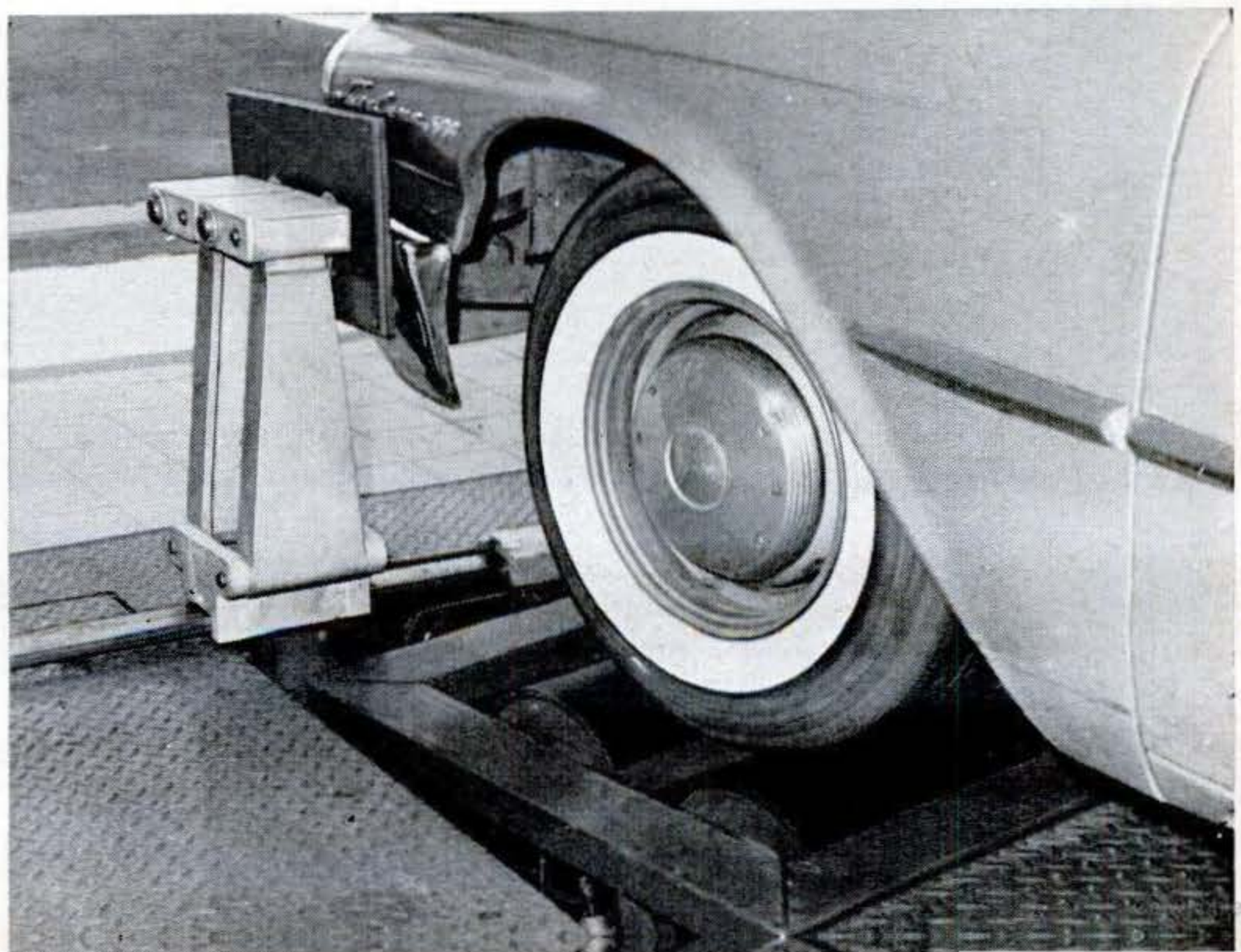
3 On dynamometer rolls, wheel balance and brakes are checked. With rear wheels on rolls (Station Two), engine power output and power absorption by power train are determined.

4 Engine-exhaust analysis shows carburetor efficiency. Oscilloscope helps pinpoint trouble with ignition system. Fuel flowmeter gives m.p.g. Other instruments are designed to test spark advance, cranking voltage, firing voltage available, regulator cutout, and fuel pressure.



5 Primary ignition timing is checked. Oscillograph tests automatic-transmission cars for shift points and quality of shift during hard-throttle acceleration. Console in background holds voltmeter, ammeter, oscilloscope, and alligator clips for electrical hookups.

6 Wheel - alignment measuring machine consists of a pair of rolls for each front wheel. Here, at Station Three, each pair of rolls turns independently of other. Wheels are free to pivot both horizontally and vertically. Degree of movement is interpreted on meters as toe-in and camber. Amount of caster is automatically computed from camber readings at two preset steering angles. Pylons hold car steady as steering wheel is turned.



After repair, job is checked out on standard Sun dynamometer. If motorist has the Center do his work, diagnostic charge is reduced by five percent of his total bill, up to $4.75.

sion-fluid analyzer to establish acid content.

Procedures are new:

- All the diagnostic machinery is crammed into one room, or bay, measuring only 25 by 60 feet.
- The diagnosis is done on the spot *before* your car goes to the repair bays.
- The analysis is as dispassionately accurate as highly refined instrument probes can make it, and they are manipulated by technicians who have had long training in their use.
- The man in the white smock sits you down at a neat desk and patiently goes over with you the results of the diagnosis and the cost of the needed repairs.
- The cost is reasonable. I had my front wheels aligned for $7.95. Many shops in my area would have charged $12 upward.
- Finally—to repeat—you can have your car repaired at the Service Center, or anywhere else you please, or do it yourself in your back yard, or let the whole thing drop.

It is not to the advantage of the Repair Center to tell you that you need, for instance, a transmission overhaul when you don't. It is, in fact, to its disadvantage—the sore customer would want no more Mobil gas and oil.

While almost everything in the analysis bay is recognizable by the better mechanic, Mobil has refined both its instruments and techniques, and added a couple of items. The Center tests wheel balance without removing the wheels, and establishes front-end toe-in and camber while the wheels are revolving.

To see just how good the Service Center was, I ran four cars through the diagnostic bay—a '53 Hudson Hornet, '61 Ford, '62 Corvair, and '63 Imperial.

The Hornet, used by PS Editor Robert P. Crossley as a station car, had been newly tuned at a cost of $65. The clinic found that the distributor points were misaligned, the cam was faulty, the coil had a reversed polarity, and the accelerator pump was twice too rich. Apart from that, the headlights were out of focus, the front wheels were out of alignment, and the brakes were unbalanced.

The Ford I had borrowed from a used-car lot. The dealer had told me, perhaps tongue in cheek, it was in "pretty good shape." He didn't know his car. When I showed him the results of the diagnosis, he promptly added $100 to its price.

The Corvair was my own. Here the system momentarily goofed. The technicians had to run it through the diagnostic bay twice before they got to the trouble—a loose mounting plate on the distributor. To a man, the Repair Center blushed to the roots of its hair.

The Imperial had been newly tuned. The tests showed only a too-lean mixture.

The Service Center was planned so meticulously that the diagnostic bay is supplied with tables for performance-by-age on all cars domestically manufactured since 1958. The Socony Mobil laboratories at Paulsboro, N.J., had advised the Center, for instance, how the 1961 Ford, considering an average mileage, should behave.

Do they cover everything? No. The Center's analysts don't make a visual inspection of shocks and exhaust system. They cannot check brake-lining thickness or pinpoint a chip off a differential gear—although they *can* tell that a dif-

[Continued on page 230]

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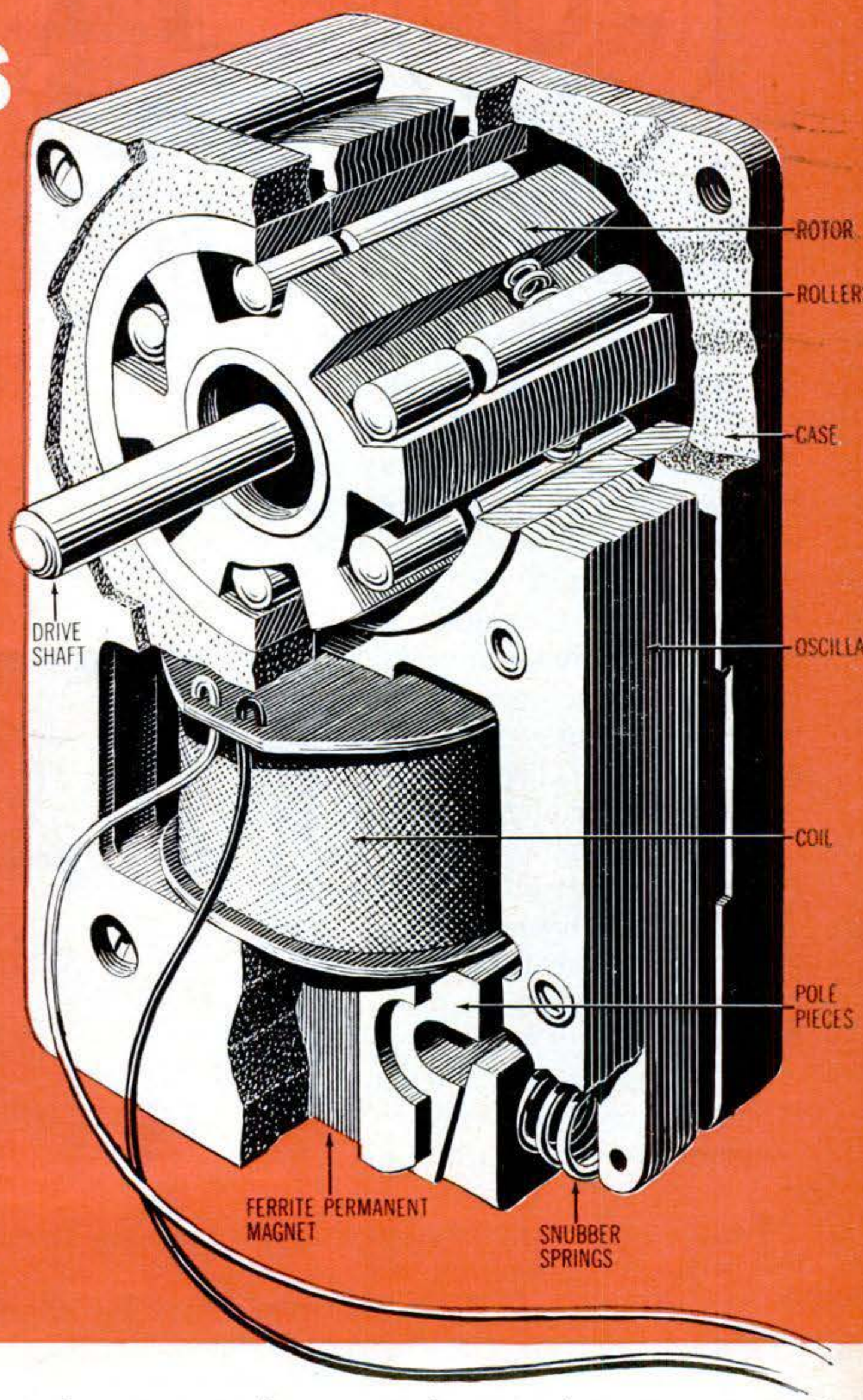
New Motor Makes News by Going Slow

A radical design approach to high-torque electric motors does away with the usual gear-down devices

By Hubert Luckett



THE more you know about electric motors, the harder the Enercon story is to believe. It defies just about every electric-motor axiom you've ever heard. Just now going into production, it should find its way quickly into major household appliances, office machines, vending machines, automated industrial machines, autos, spacecraft.

The Enercon does what hundreds of inventors have been trying to get an electric motor to do ever since Tesla invented the AC motor:

▶It goes slowly. Without gears, the mo-

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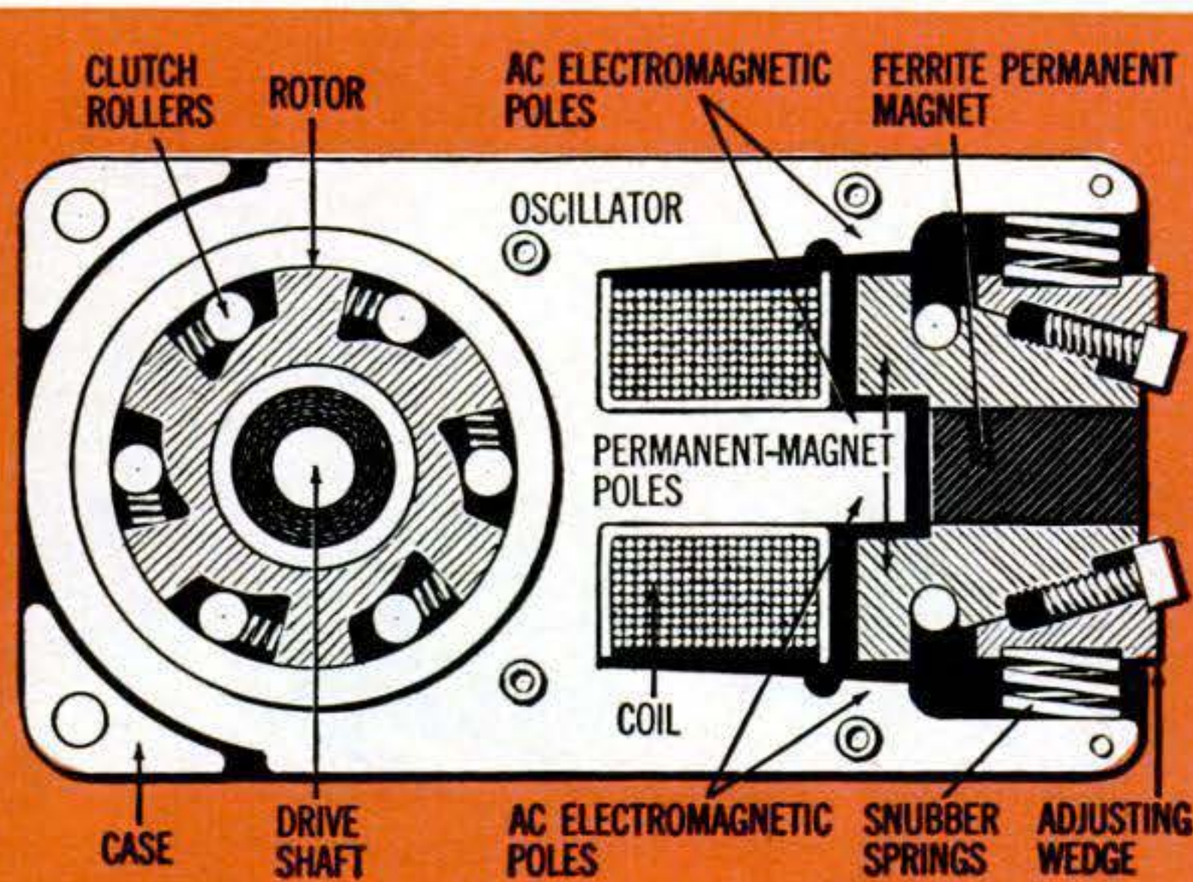
Enercon's revolutionary principle produces mechanical



Oscillator swings about center of rotor shaft, guided by annular ring riding in groove in outer housing. Rotor is inched around by roller clutches as oscillator swings back and forth. Power to move oscillator comes from AC flowing through coil surrounding center leg of E-shaped end of oscillator. Since current is alternating, polarity created reverses 60 times a second. Poles of a ferrite permanent magnet fit into oscillator-pole gaps, giving four sets of working pole faces. On each cycle, two pairs of poles pull, two push. Snubber springs and adjustment wedges control amplitude of oscillation, and hence speed of rotor.

tor rotor itself turns at a deliberate pace of as little as one-half r.p.m. It can be adjusted to run up to 35 r.p.m.

▶It delivers full torque and reaches operating speed almost instantly when you throw the switch and give it juice.

▶It can't be damaged by overload. It draws the same current whether or not the rotor is turning.

▶It will index accurately to one-tenth of a degree without brakes or clutches.

▶It will run indefinitely. Little lubrication is needed, and there is almost nothing to wear out at its low speeds.

▶It can be built to run forward or backward, or even alternate rotations rapidly by manual or automatic control.

Ready-made applications for such a motor are, of course, extremely varied. The manufacturers of Enercon, the Energy Conversion Systems Corp., Grafton, Wis., are aiming their first models at the rich market for servo controls and low-speed drives in consumer appliances and office machines. These jobs are now handled by conventional motors with high-speed rotors, elaborate gear trains, and, in many cases, tricky arrangements of brakes, clutches, levers, and detents.

Inventor: James S. Neal's work on free-piston engine led to slow motor.

The new motor promises a saving of up to 80 percent in size, 50 percent in direct cost. Even more important to the customer, the utter simplicity and inherent ruggedness of the new design promise a long, trouble-free life.

Two models of the Enercon motor are now coming off the production lines. Model 45 is 2½ by 1⅜ by 1 inches, weighs 12 ounces, and delivers 10 inch-pounds of torque. Model 65 is 3½ by 2 by 1½ inches, weighs 1 pound 4 ounces, and delivers 25 inch-pounds of torque. Design prototypes have been built with a torque output of 80 inch-pounds. Theoretical projections of limitations on the design indicate a maximum size of ¼ horsepower. Higher outputs can be obtained by ganging several units.

The production models are also available with programers that allow for stops and starts at multiple points around the circle of rotation, or with a homing device that will stop the rotation at selected points with an accuracy of one-tenth of a degree.

The slow-motor man. This first new concept in electric-motor design in 60-

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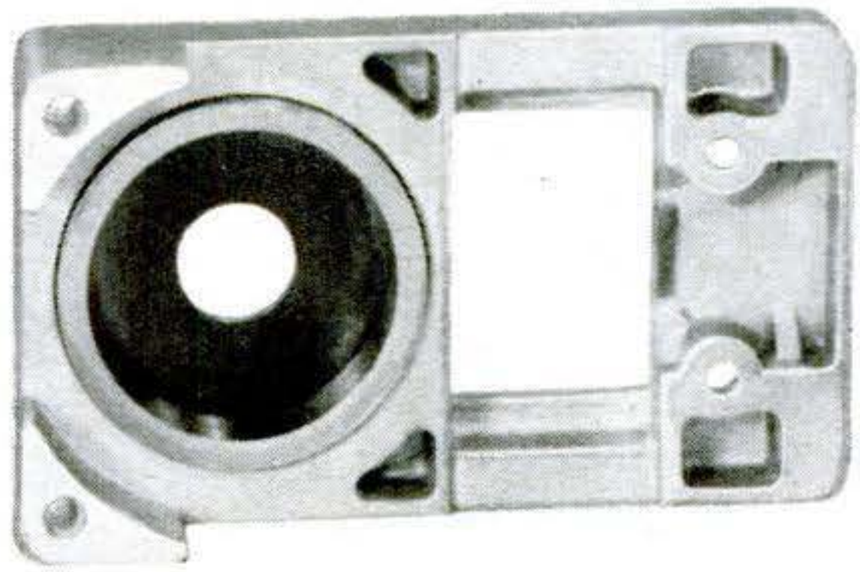
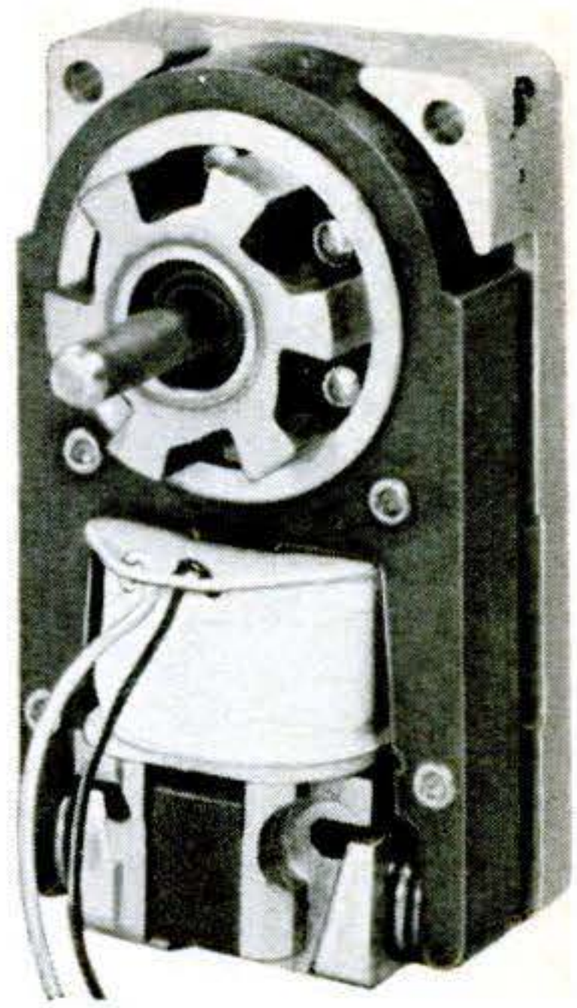
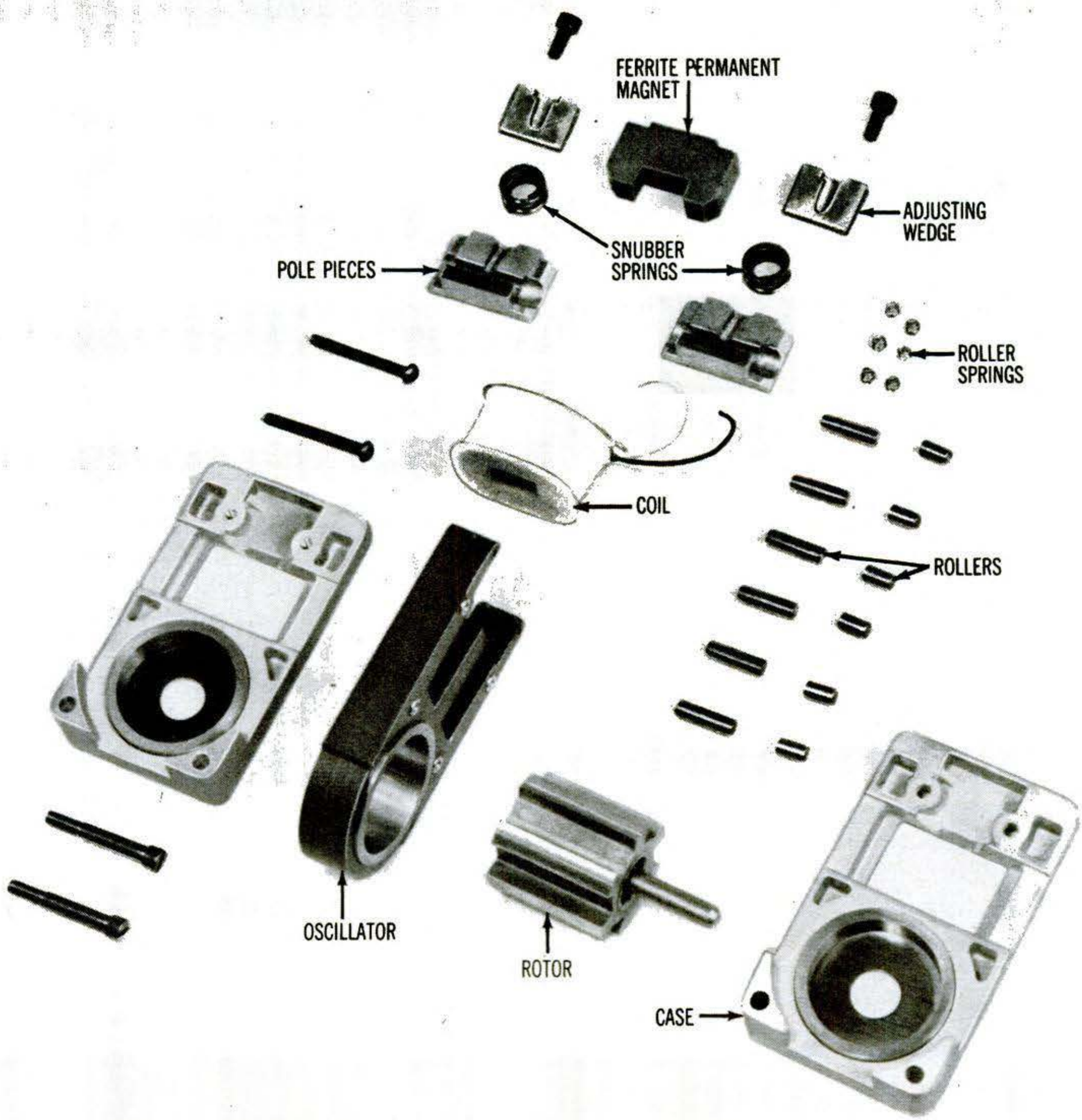
oscillation, turns it into rotary shaft motion

With side case removed, Enercon works can be seen. Oscillator is made of transformer iron laminations. Hardened steel ring inserts in oscillator and case surround rotor. One set of rollers is in place; the smaller, holding rollers that work against case, is not shown.





Layout of Enercon parts: Wedging chambers in rotor taper at an angle of 17 degrees. Pole pieces conduct magnetic flux from poles of the permanent magnet into gaps formed by E-shaped end of the oscillator.



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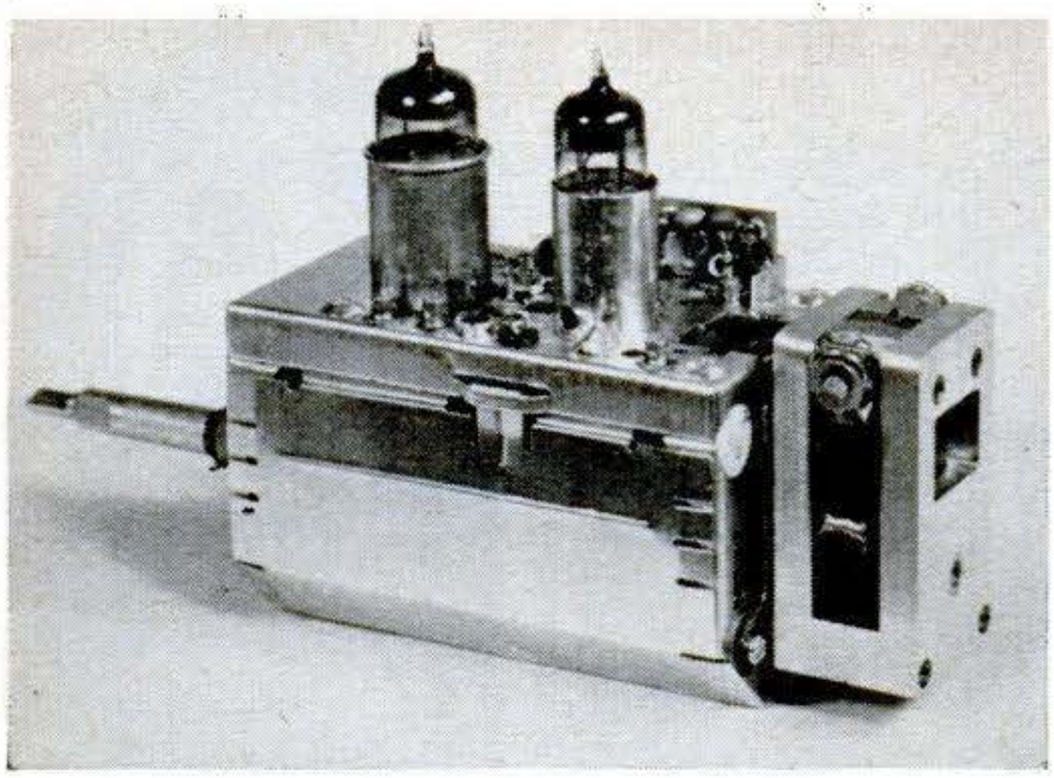

For TV: Enercon motor is mounted on back of TV tuner. Inherent indexing accuracy of motor makes mechanical detents unnecessary. It can be used for pushbutton tuning or remote control.

odd years came not from the laboratories of a giant corporation but from the brain of a young, free-lance industrial designer. James S. Neal, now vice-president of ECSC, was working on a free-piston-engine design when he hit upon the basic idea of the Enercon motor. The mechanism he worked out for converting the high-speed oscillation of a free piston into low-speed, high-torque, rotary motion looked as though it would work even better on electric power—and he shelved the free-piston engine.

How it works. If you will think a moment of the ratchet handle on a socket wrench, you'll get a pretty good idea of one of the basic principles behind the Enercon motor. When you move the handle back and forth (oscillate it), you impart rotary motion to the nut. It will rotate in one direction if the nut is tight on the threads; but if it is loose, it won't offer enough resistance on the backstroke to release the ratchet. By gripping the socket lightly during the return, you can keep the nut turning in one direction.

Now imagine a pair of ratchet-like devices capable of taking extremely small "bites" on a perfectly smooth, continuous surface—no pawls or ratchet teeth. One "ratchet" advances a rotor a tiny portion of a revolution when a lever is moved in a given direction, the other holds the rotor while the first is backing up for another bite. Here you have the mechanical means of producing continuous, smooth rotary motion from an oscillating lever. You can make the rotation as uniform as need be simply by taking small, rapid bites.

All you need now to make a motor is a way to oscillate the lever efficiently. Ordinary AC electric power oscillates at 60 cycles per second. Fed into the coil of an electromagnet, it will cause the poles to reverse polarity 60 times a second. If you could arrange the lever so it would be alternately repelled and attracted by this polarity reversal, you'd have a simple mechanical oscillator.

This is the point at which previous efforts along these lines failed. The obvious answer is a permanent magnet at the end of the lever. The trouble is that ordinary permanent magnets soon become demagnetized if left in an AC magnetic field.

If Neal had tried to develop his motor a few years ago, he would not have been able to solve this problem. The solution came with a magnetic material originally designed for computers: a ceramic called ferrite. Ferrite magnets are powerful for their size and retain their magnetism where other materials fail.

Where will you see it? Probably the first appliance to reach the market with the new motor will be a TV set with a motorized tuner. It may be either pushbutton-operated or remote-controlled. Present design work on this application indicates a 70-percent reduction in size over power units now in remote-controlled sets and a substantial reduction in costs. Another company is investigating the possibility of eliminating all the cams, gears, and levers in their automatic record changers; an Enercon would accomplish all the motions needed during the change cycle. Electric can openers, tape recorders, ice makers, photocopy machines, and coin-operated vending machines are among the products now being redesigned to use the new motor.

With the addition of a transistor oscillator so the motor can run on battery current, some auto makers are considering it for power windows, power seats, and windshield wipers. ■■

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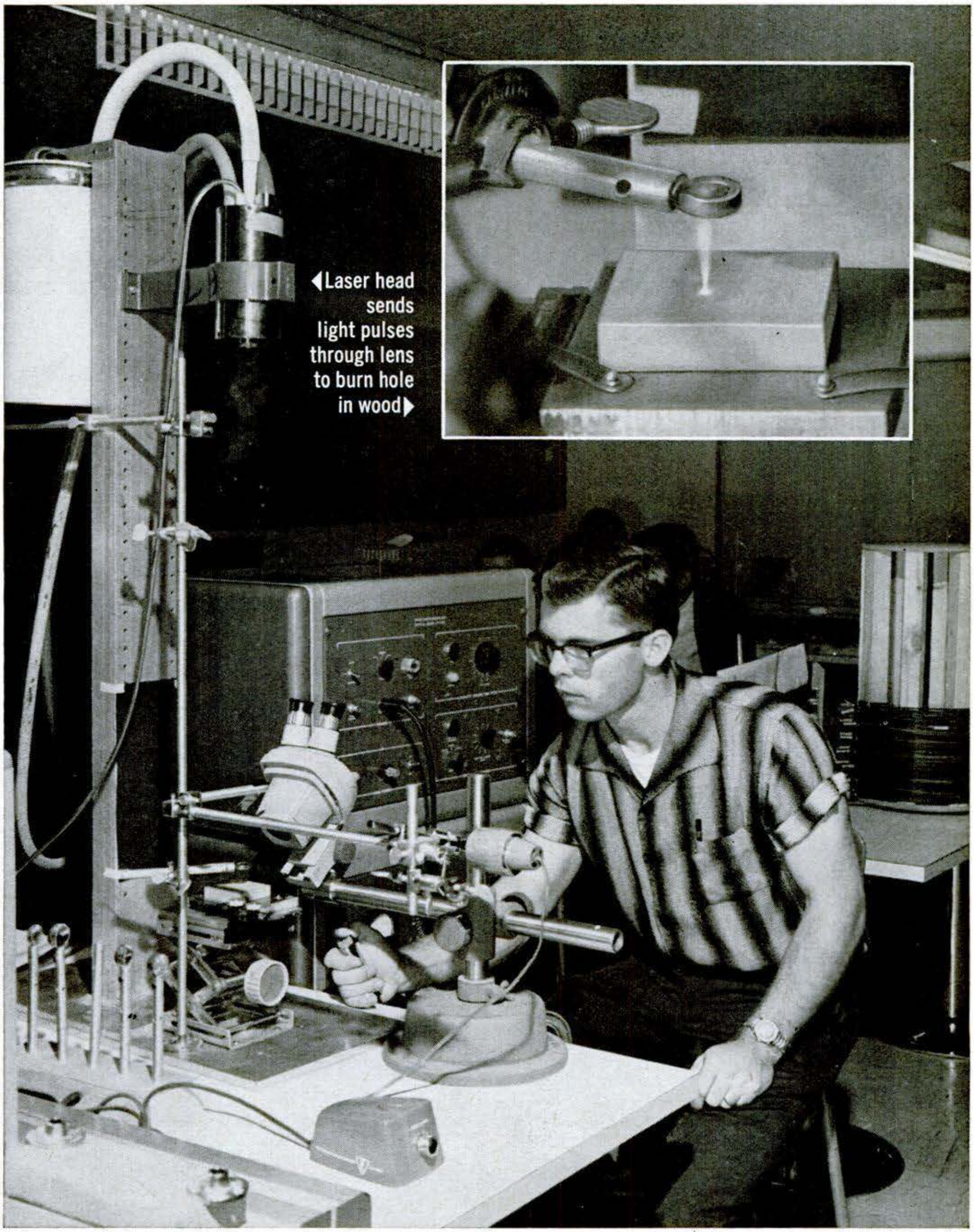

◀Laser head sends light pulses through lens to burn hole in wood▶

Cutting wood with a beam of light

A new technique in woodworking may be on the way. The University of Michigan has developed a tool that cuts through maple and other hardwoods with bursts of light that act like the science-fiction writers' disintegrating-ray gun. The experimental drill operates with a laser (light amplification by stimulated electron radiation) head that contains a coiled xenon flash tube and a ruby rod. It builds up intensely hot light pulses, focuses them through a lens to vaporize a hole in a block of wood instantly without leaving char. It's not ready yet for the home workshop.

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Dr. von Braun discusses space problems with Editor Bob Crossley on visit to POPULAR SCIENCE offices in New York.

Dr. Wernher von Braun Answers Your Questions About Nuclear Rockets

Q ***How will nuclear power be used for space flight?***

A Two different concepts are in the works: the nuclear blowdown rocket and the nuclear ion rocket.

The nuclear blowdown rocket can be designed, just as a chemical rocket can be, for any amount of thrust. It can produce as much thrust as the best hydrogen-oxygen combustion rockets, for twice as long, with the same total propellant consumption. In other words, it is about twice as efficient in use of propellant. It works not only in outer space, but also within the atmosphere.

The nuclear ion rocket yields only feeble thrust, and does not work within the atmosphere. But it can exert its weak thrust for long periods, enabling a space vehicle gradually to build up enormous speed. It is about 10 times as efficient as a nuclear blowdown rocket.

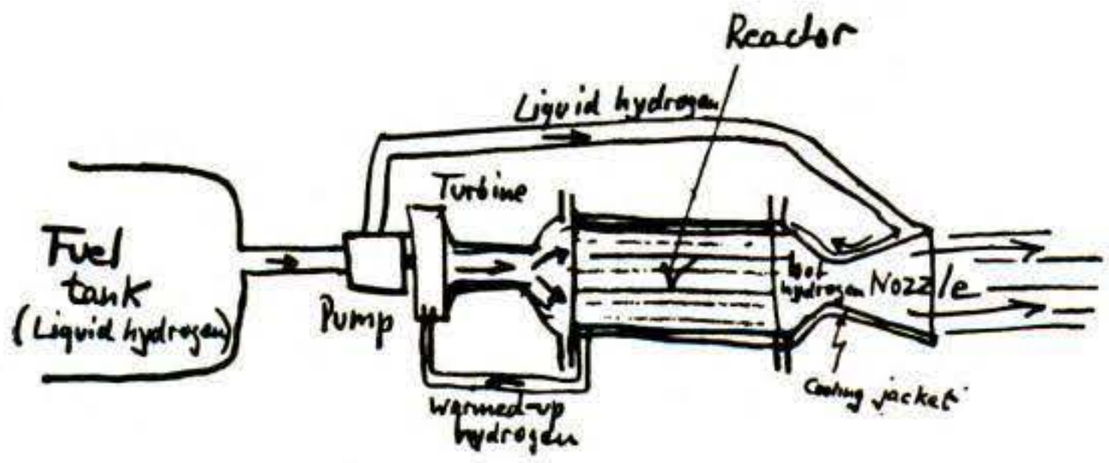
Q ***Will these different nuclear rockets serve different purposes?***

A Yes. A nuclear blowdown rocket has the most promise as an upper stage of a very large, chemically boosted space vehicle. Such a craft could provide a highly economical round-trip transportation system between Earth and Moon.

The nuclear ion rocket seems destined for use as "cruise power" for interplanetary travel. It offers a vast increase in payload for planetary exploration, without recourse to excessively large and costly earth-launched rockets.

Q ***How does a blowdown rocket work?***

A In essence the nuclear blowdown rocket is a reactor, perforated by narrow channels into which liquid hydrogen is pumped. When control rods are withdrawn, a neutron chain reaction makes the reactor white-hot. The control rods' action holds this temperature level.



Fed by a turbine-driven pump, liquid hydrogen flows first through passages for cooling the exhaust nozzle and the reactor's pressure vessel. Still pretty cold but already gasified, it enters the reactor. In the reactor's tubular channels, the hydrogen is heated to a temperature of several thousand degrees. Then it spurts from the exhaust nozzle.

Because of the very low molecular weight of hydrogen, exhaust velocity is very high, and this means a most economical use of propellant.

Q ***What is the principle of an ion rocket?***

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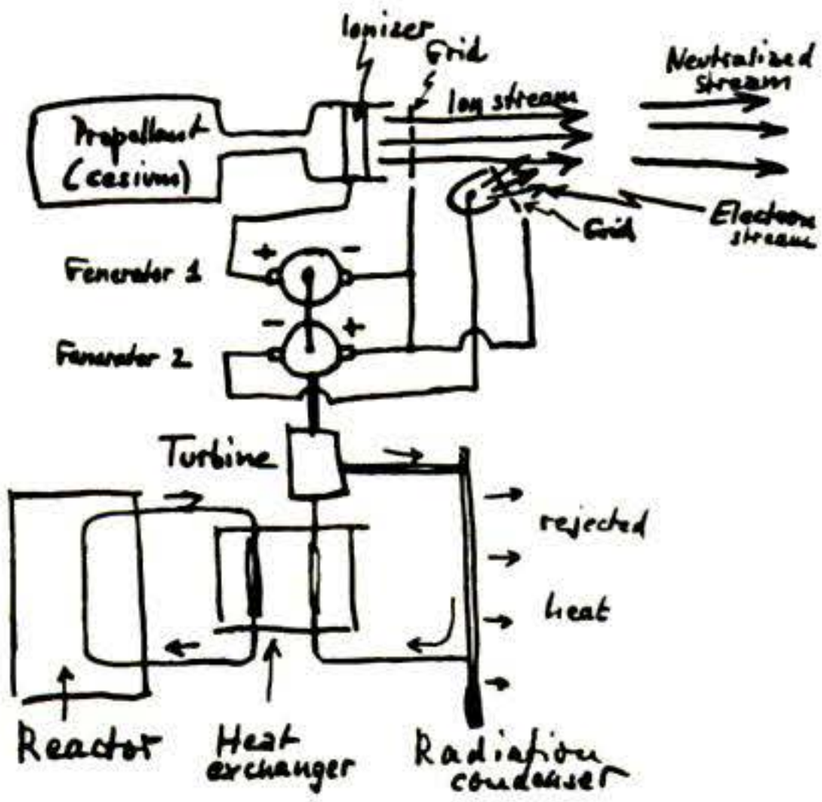
A In this type, the reactor's nuclear energy is first converted into electrical energy. That takes relatively heavy machinery, such as turbogenerators, heat exchangers, and radiation condensers.



In one ion-engine design, the easily liquefied metal, cesium (melting point, only 83 degrees F.), is pumped through a porous and incandescent tungsten plate called the "ionizer," from which it evaporates. As it does so, a negatively charged electron is stripped off the cesium atom. Originally electrically neutral, the atom now becomes a positively charged ion.

To a grid in front of the ionizer, a generator applies a negative voltage. Since unlike charges attract, the negatively charged grid accelerates the stream of vaporized, positively charged cesium ions—and hurls them into the vacuum of space beyond, at a speed of 60 to 100 miles per second. The thrust of an ion rocket comes from the reaction force on the grid.

Of course, if we kept expelling positive ions from a rocket ship, it would soon build up a powerful negative charge—and its attraction would prevent any more positive ions from escaping. But there is a simple remedy:

All we have to do is to take those negative electrons that were stripped from the cesium atoms—and, with a second generator, "pump" them into the stream of escaping ions. This neutralizes the ion jet (or "beam," as ion-rocket men call it), and the electrostatic balance of the ship is restored.

Obviously the power rating of the electrical conversion equipment must at least equal the power carried away in the beam. (Because of conversion losses, it must actually be greater.) So very substantial machinery is needed to produce even as little as a pound of thrust. Thus, aside from the fact that it wouldn't work in the atmosphere anyway, an ion rocket could never lift its own weight off the ground.

But in outer space, with zero gravity, we do not need a thrust exceeding the ship's weight. Apply only one pound of thrust to a five-ton rocket ship, for a whole week, and you build up a speed of more than 1,300 m.p.h.! The capability of such long-sustained thrust and unmatched fuel economy explains why ion propulsion is considered the key to manned interplanetary exploration.

Q ***What is an analog-digital conversion system?***

A Actually it is one of those wordy but fashionable space-age terms for an old idea.

There are two fundamentally different "modes" or ways of displaying data: the *analog* mode and the *digital* mode. The speedometer in your car employs the analog mode, because the angular deflection of the needle is analogous to the speed at which your car is traveling. But the odometer, whose set of jumping figures totals the mileage you have put on your car, uses the digital mode of display. It presents the mileage directly as a five- or six-digit number.

Acquiring many items of in-flight data simultaneously is of paramount importance for the development and operation of space rockets. All these data must be radioed down to the ground through telemetry links.

Now, many data are collected most easily in analog form, and need not be extremely accurate, anyway. For instance, the pressure in a rocket's propellant tank can be measured quite simply by a manometer, working on a variable resistor

[*Continued on page 198*]

The Popular Science SPOTLIGHT AWARD

On this page POPULAR SCIENCE inaugurates a program of Spotlight Awards to companies and individuals for outstanding contributions to American living, as measured by the invention, design, development, engineering, and manufacturing of products, methods, and materials.

The Spotlight will focus on the range of consumer products that concern our readers—automotive, home-improvement materials, tools, photography, boats, outdoor recreation, electronics.

The first selection of PS's Editorial Board is the—

Ford Econoline Van

The development of this vehicle as a mobile shop for small service businesses, a delivery truck, a family camper, and a multipurpose carrier for hobbyists and businessmen alike, has earned this **Popular Science Spotlight Award** for Ford.

Readers who have long looked to our magazine for news of mechanical and scientific developments will find in the Spotlight a new way of illuminating outstanding products and inventions.

Inventors, designers, engineers, and those charged with bringing to market the new machines and materials that promote employment and man's material and cultural progress, will find a special recognition in the Spotlight Awards.

The Ford Econoline Van (see story at right) is a fitting recipient of the Spotlight, first turned on at the 1963 Chicago Automobile Show. Ford carried forward the design and engineering of this essentially new type of vehicle, and added adaptability, space, and performance. In future months you will learn about other significant new products in POPULAR SCIENCE, the magazine that reports the results of science—those material developments that provide a better life.

Robert P. Crossley
Editor

John R. Whiting
Publisher

How to

Vans are starting a trend: Build a workshop or store into one and drive to your customers

By Harry Walton

THERE'S a new way to go into business—on wheels. You do it with one of the new van-type trucks. These snub-nosed, amazingly roomy vehicles—already popular for camping—are now rolling as mobile workshops, armored cars, doughnut kitchens, and stores—besides hauling everything from laundry to pianos.

Robert E. Miller, a locksmith in Windsor, Ontario, fitted his Ford Econoline van to do door-to-door key making, lock repairs, mower and tool sharpening. In Springfield, Ohio, Jay D. Tyree installed an extra generator and electric doughnut-making equipment in two Volkswagen Kombis. They roll around town surrounded by a sales-making aroma. Van and generator cost three dollars a day to operate—far less than downtown store rent. The business has grown into a fleet of 40 vans.

Selling possibilities are boundless. You can build a merchandise display in a van and drive to your prospect's doorstep. Canny sales departments fit vans with seats, electric typewriters, and even bars. The prospect is lured away from his own desk and phone, to be given an uninterrupted sales pitch. One shoe company sends its entire sample line on the road—directly to prospects. John Miller, who runs a boot-and-saddle shop in Tucson, Ariz., loads his VW panel van with stock on weekends and drives to rodeos and horse shows.

Many businesses are crying for the on-the-spot service you can render with a van. Mobile welding shops, elec-

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Succeed in Business Without an Office

Louis Neal of Birmingham, Ala., has a cutting table in his Econoline, hauls glass in back.

In its rallies, the N.Y. Region of the Sports Car Club of America uses this Econoline as a registration office, check-point shelter, and emergency ambulance with bunk and stretcher (right). It carries timing equipment, a P.A. system, flags, phone, and two miles of wire.

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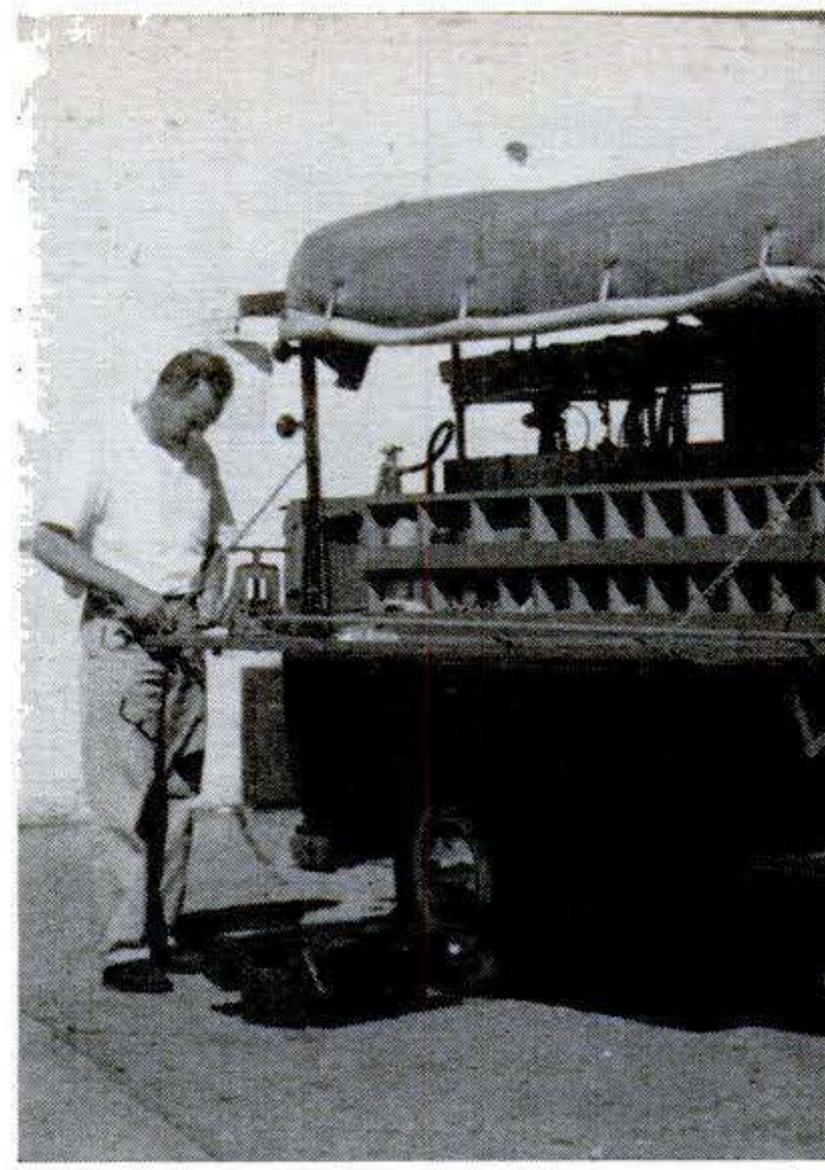
Big doors swing wide for easy loading of air-conditioning and heating equipment in this Volkswagen van. There's plenty of room to carry a complete stock of repair parts.



A handy man with wrench or brush, this Ohio Volkswagen owner does home repairs and

These rolling repair shops and sales displays go where

tronic test centers, and photo studios are already on the road. Local dealers for a nationwide carpet- and furniture-cleaning company are using the vans for home-service calls. A man with special skills could equip a van for home-appliance repairs, typewriter servicing, trouble-shooting outboard motors.

Offbeat jobs for vans include a demonstration of missile telemetry in an Econoline that tours the country, a one-man VW bus line, and an armored car. This is a VW panel van with bullet-stopping fiber-glass-and-plastic wall lining and thick plastic windows. It carries mail and bank deposits around Nashville, Tenn. George R. Creegan, a magician and puppeteer, manipulates his actors through the sun roof of a VW.

The van idea, pioneered by Volkswagen, has been further developed here by Ford and Chevrolet. On a 90-inch wheelbase—4½ shorter than a VW sedan's—the Ford Econoline packs 204 cu. ft. of cargo space and a load capacity of 1,675 pounds. Its tight turning radius and 168.3-inch overall length (only about 8 inches longer than the same VW sedan's) make the Ford van easier to maneuver than most family cars. The Volkswagen Kombi or van can lug 1,786 pounds in a load space of 170 cu. ft. The Chevrolet Corvan, with 191 cu. ft., has a payload of 1,800 pounds.

Volkswagen and Corvan engines are in the rear. The Econoline's six, available in 85- and 101-hp. ratings, is tucked alongside the driver. Its three-speed transmission is synchronized even in low, and an automatic-drive option is coming up. With an optional "one-ton package" of heavy-duty parts, the Econoline's load capacity is boosted to 2,100 pounds.

Big four-by-four doors in back and on the curb side make loading easy. Extra left-side doors are optional on the '63 Econoline. Over five feet wide inside, it has a fully flat floor, only knee-high from the ground in back as well as at the sides.

Besides hauling their tools in vans, plumbers and other mechanics build in bins for spare parts. Utility companies mount ladders on van roofs to make them mobile maintenance towers. More than 10,000 Econolines are in use by telephone companies. ■ ■

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decorating. He can carry long ladders, tools, and supplies, and do some work in the van.

On-the-spot demonstration of kitchen ranges is the idea behind this display. It enables its owner to show his complete line to home builders at construction sites or at their offices.

the business is—to give customers on-the-spot service

One of a fleet, this Chevrolet Corvair 95 panel van carries a varied display of GE equipment to electrical wholesalers and contractors, familiarizing their personnel with new products. The vans also appear in stores, exhibits, industrial plants, and even hotel lobbies.

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After Telstar, what?

The Stay-Putnik

It's our new Syncom, a satellite that promises a better bounce for world-wide TV and telephone

By C. P. Gilmore

THE newest U.S. communications satellite—scheduled for launch this month or sooner, in an attempt to top Telstar—can't be expected to streak across the sky at regular intervals. To the operators of a tracking station, it won't even seem to be in orbit. Instead, the unnatural instrument package will hang around over the Atlantic, tracing a lazy north-south figure-8 every 24 hours.

A more advanced model won't even do that. It will appear to stand still in the sky, poised interminably over a single spot on the earth's equator.

Can such things be? Sure. That thing *will* be orbiting the earth, but 22,300 miles up. At that height, the speed necessary to balance the earth's gravitation makes it take exactly 24 hours for a single orbit. So the satellite will appear to hover, without east-west movement.

This satellite is called Syncom because its orbit is *syn*chronized with the earth's rotation, and it's a *com*munications satellite. That also spells superiority over Telstar, in the minds of one group of space planners—those who advocate synchronous satellites as *the* solution to the problems of world-wide phone calling, TV viewing, and data transmission by means of space stations that relay signals from one ground station to another. (The first model, incidentally, will be equipped only for phone calls.)

What problems? During most of its lifetime, Telstar worked fine [see "Science Newsfront," page 17]. Yes, but only thanks to a great deal of engineering ingenuity. Massive, pivoted transmitting and receiving antennas had to "acquire" the satellite as it came into line-of-sight, then track it across the sky during the short time it was available for work in each 2½-hour orbit. Such methods will be necessary even with a pack of at least 30 satellites rambling around the earth in random orbits (the scheme for a network of Telstar-type repeater satellites).

Obviously, transmitting transoceanic and transcontinental signals would be a lot easier with the aid of a satellite that's not forever disappearing over the horizon. A synchronous system, in

Merry-go-round of whirligigs in space

Ultimate satellite communication network, seen from above the North Pole, would require only three advanced Syncom relay stations, spaced evenly around earth's equator in synchronous orbit. Traveling at 6,880 miles per hour in an orbit 22,300 miles high (white circle), in same direction as earth's rotation, each satellite keeps pace with a spot below it on equator, always "sees" same 40 percent of earth's surface. To relay signals from point to point within that area, using limited transmitter power, Syncom must keep radio beam aimed accurately at the earth. Each satellite is spin-stabilized like a top, keeping its axis parallel to that of earth (direction of spin is opposite to spin of earth). Radio beam would sweep around uselessly in space (colored circle); however, beam is rotated electronically around antenna in direction opposite to satellite's spin (colored arrow) to keep it always aimed at earth, like a weight held by gravity.

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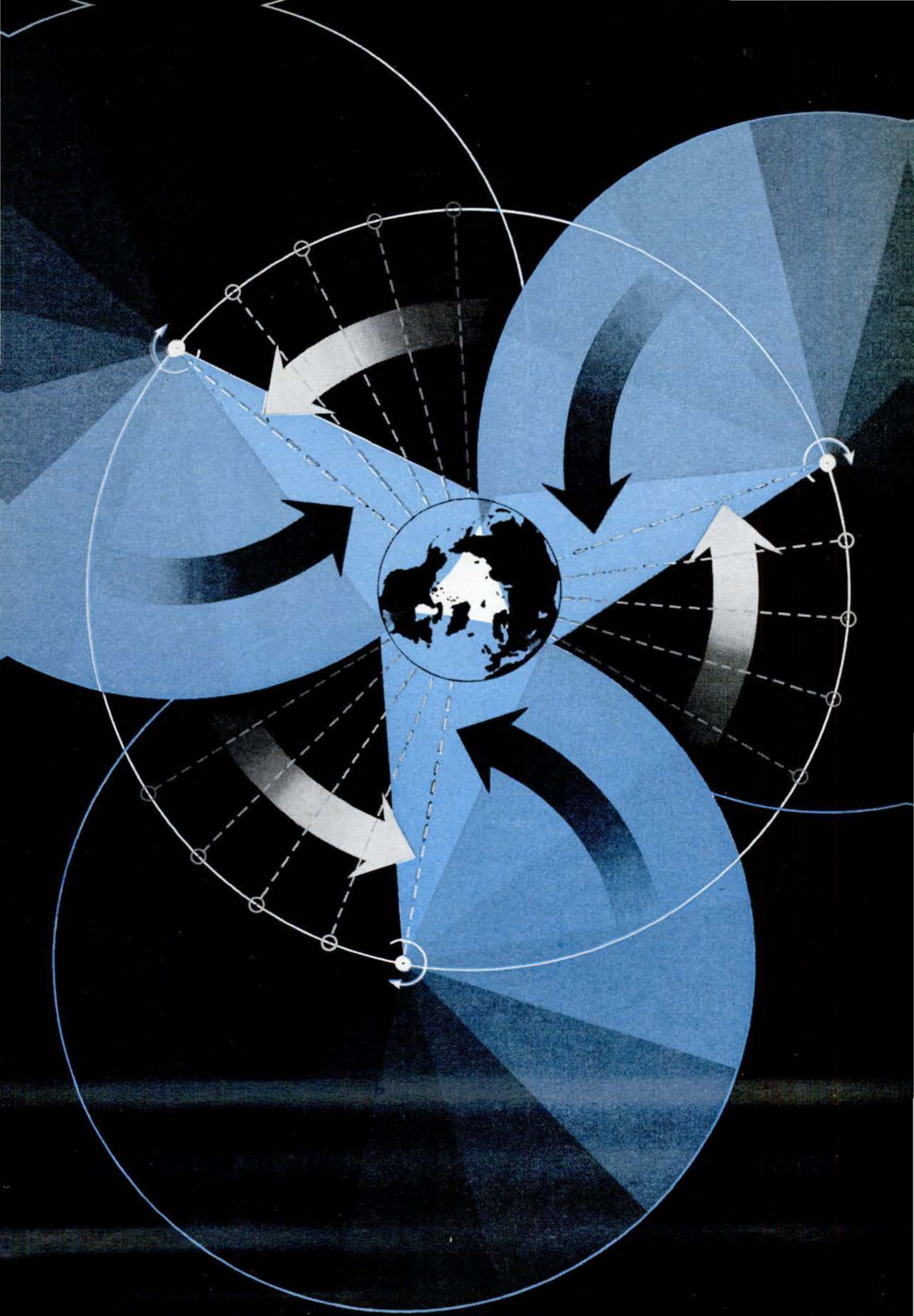

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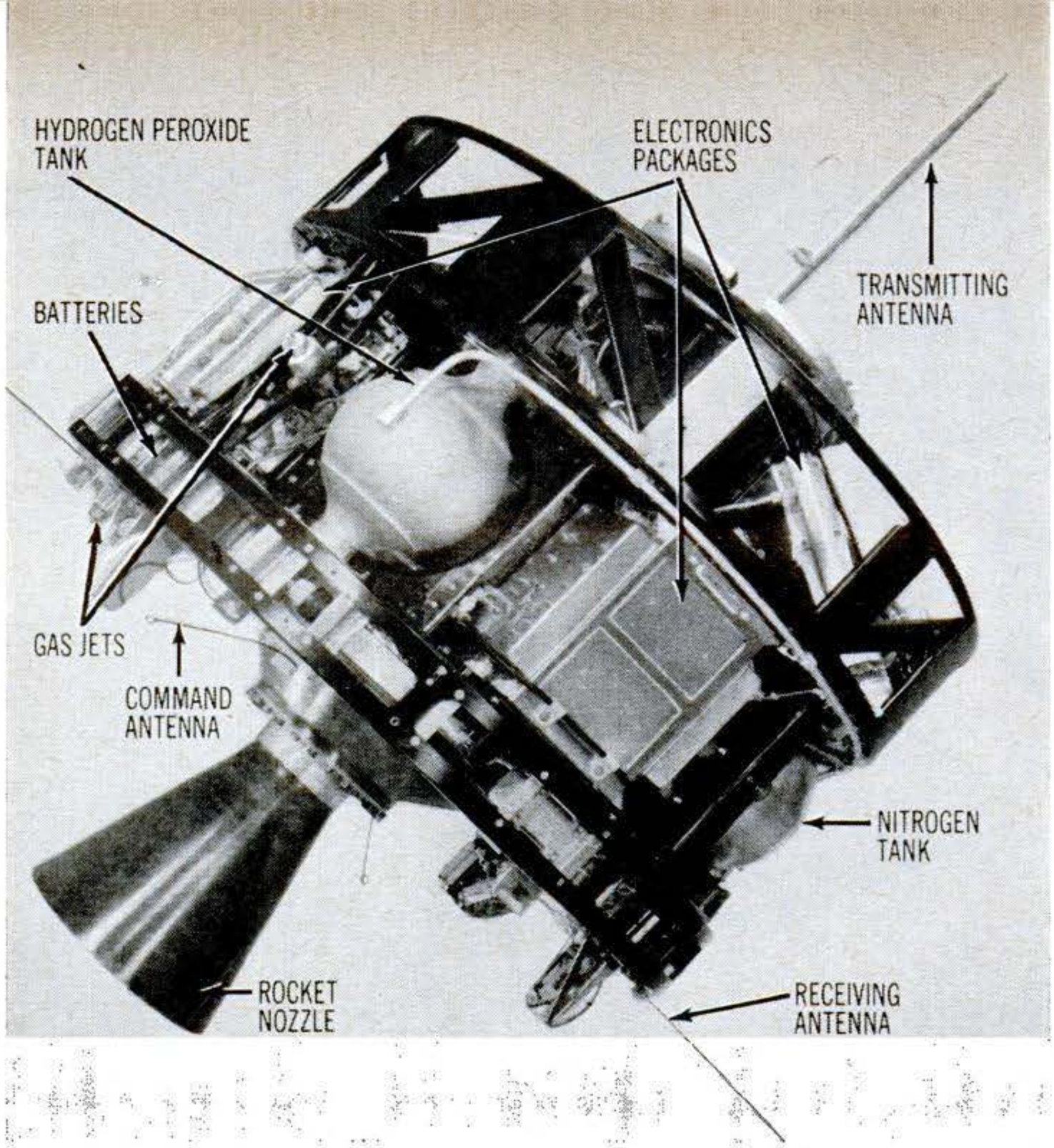

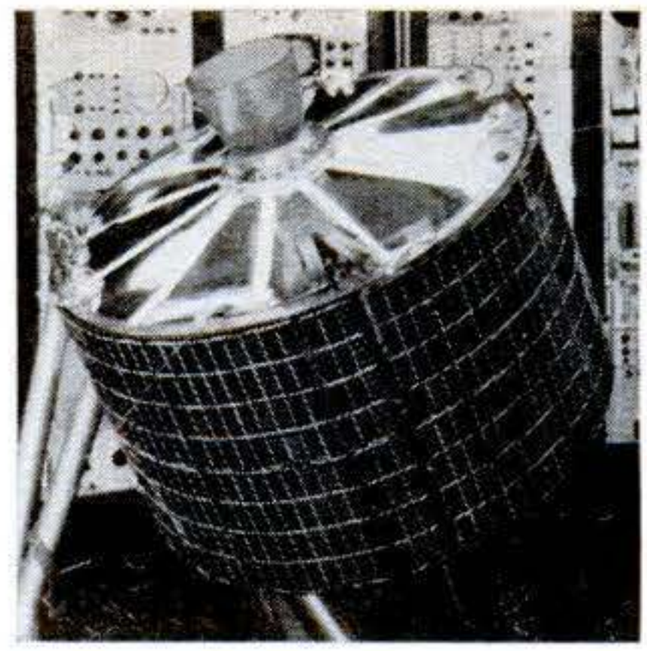

Ready for space after assembly, Syncom is powered by jacket of solar cells, seen above; also has nickel-cadmium storage batteries, shown in interior view, left. Nozzle of built-in rocket motor, using solid fuel, protrudes from bottom of instrument package. Nitrogen and hydrogen peroxide tanks feed small jets to control velocity and angle in orbit. Whip antennas at bottom receive commands and signals to be relayed. Transmitting antenna is at the top.

fact, can cover all populated parts of the world (but not the polar regions) with only three satellites, as long as they're spaced evenly, right over the equator.

Sounds easy, but Syncom is about the trickiest device we've ever tried to launch into space. A few reasons:

- No satellite has ever been orbited with the kind of precision required by Syncom—a combination of great height (at an unusually precise altitude) and a nearly circular orbit. Tricky correction maneuvers are needed to get the satellite to hover and set it at the proper angle.
- Since the satellite is so far away, signal strength is a problem. Ideally, the satellite's radio beam should always point accurately at the earth. Satellites usually tumble and roll in space. Syncom will be spin-stabilized like a gyroscope, and its antenna's transmission pattern will be manipulated to provide optimum coverage of the earth. (The pattern sent out by the first-model Syncom is a compromise solution.)
- Both problems have been solved, say designers, but the solutions are expensive, and things frequently go wrong once a satellite is working in space. So a practical Syncom must have unusually long life and high reliability.
- An unavoidable disadvantage of high-orbit operation is that it takes six-tenths of a second for a signal to travel 22,300 miles out and return (at the speed of light). This hurts phone conversation specifically. Ask a question, and you have to wait for the answer. How serious a matter it is remains to be seen.

Actually, the first satellite-communications schemes proposed involved synchronous satellites. The idea originated with scientist-writer Arthur C. Clarke back in 1945. But because of the difficulties, other kinds were tried to begin with: first, passive reflectors—the Echo balloon satellite; then low-altitude random orbiters—Telstar and Relay.

But the synchronous satellite remained on the agenda. After a number of companies proposed solutions to the problems, the National Aeronautics and Space Administration told Hughes Aircraft: "You're elected." The men at Hughes figure they've got the answers—as shown in our illustrations. Soon—perhaps by the time you read this—we'll know how right they are. ■■

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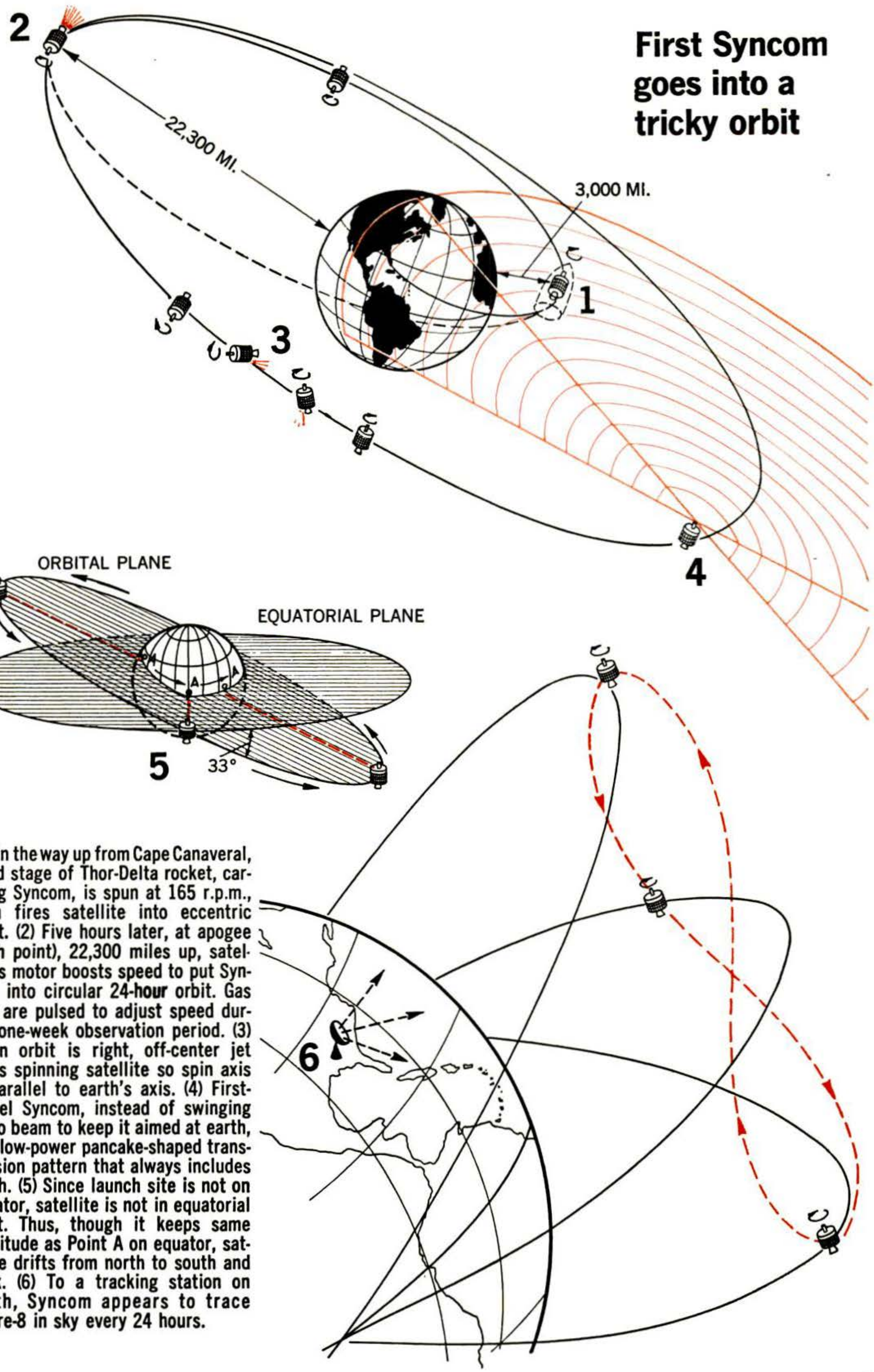
First Syncom goes into a tricky orbit



(1) On the way up from Cape Canaveral, third stage of Thor-Delta rocket, carrying Syncom, is spun at 165 r.p.m., then fires satellite into eccentric orbit. (2) Five hours later, at apogee (high point), 22,300 miles up, satellite's motor boosts speed to put Syncom into circular 24-hour orbit. Gas jets are pulsed to adjust speed during one-week observation period. (3) When orbit is right, off-center jet turns spinning satellite so spin axis is parallel to earth's axis. (4) First-model Syncom, instead of swinging radio beam to keep it aimed at earth, has low-power pancake-shaped transmission pattern that always includes earth. (5) Since launch site is not on equator, satellite is not in equatorial orbit. Thus, though it keeps same longitude as Point A on equator, satellite drifts from north to south and back. (6) To a tracking station on earth, Syncom appears to trace figure-8 in sky every 24 hours.

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Big bus becomes a mobile, on-location recording studio for special sound events.

This Is Hi-Fi?

Sports-car races are among the most successful nonmusical subjects ever recorded.

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Who needs Beethoven when you can listen to the squeal of an eel, an iron horse at full gallop, or the sound of an atomic explosion?

By C. P. Gilmore

PHONOGRAPH records used to make music. Some still do. But that's only part of the story now.

Today, there's hardly a sound made by man, machine, or anything that walks, flies, creeps, slithers, or swims that hasn't been recorded in high-fidelity and stereophonic sound. For example:

Nature lovers now dig daffy discs containing everything from eel squeals and hawk squawks to lion roars, sheep bleats, cricket concerts, alligator choruses, and the mating calls of 95 varieties of frogs.

Go for shopwork? Then relax at night to the soothing tones of a blacksmith beating an anvil, an arc welder welding, a carpenter driving nails, an electric saw, or a whole machine shop going at once.

If the house is too quiet, liven it up but stay in character by playing records of a sink draining, a phone ringing, or a vacuum cleaner running.

Need instruction in anything? In a well-equipped record emporium you can buy a platter that will tell you how to play golf, speak Swahili, fly a plane, dance ballet, make love, play the bongo, cure alcoholism, lose weight, take shorthand, become a yogi.

The offbeat-record business, now spinning along in a multimillion-dollar whirl, got its start with the beginning of the hi-fi boom after World War II. For the first time, startling realism was possible on recordings, and record companies and even a few determined individuals began combing the earth for sounds to put on discs.

An English recording engineer, Peter Handford, was a steam-locomotive buff. When the government began retiring old steam chariots and replacing them with diesels, he decided that life without the coal eaters would be too dismal. So he began spending his weekends capturing their sounds on tape.

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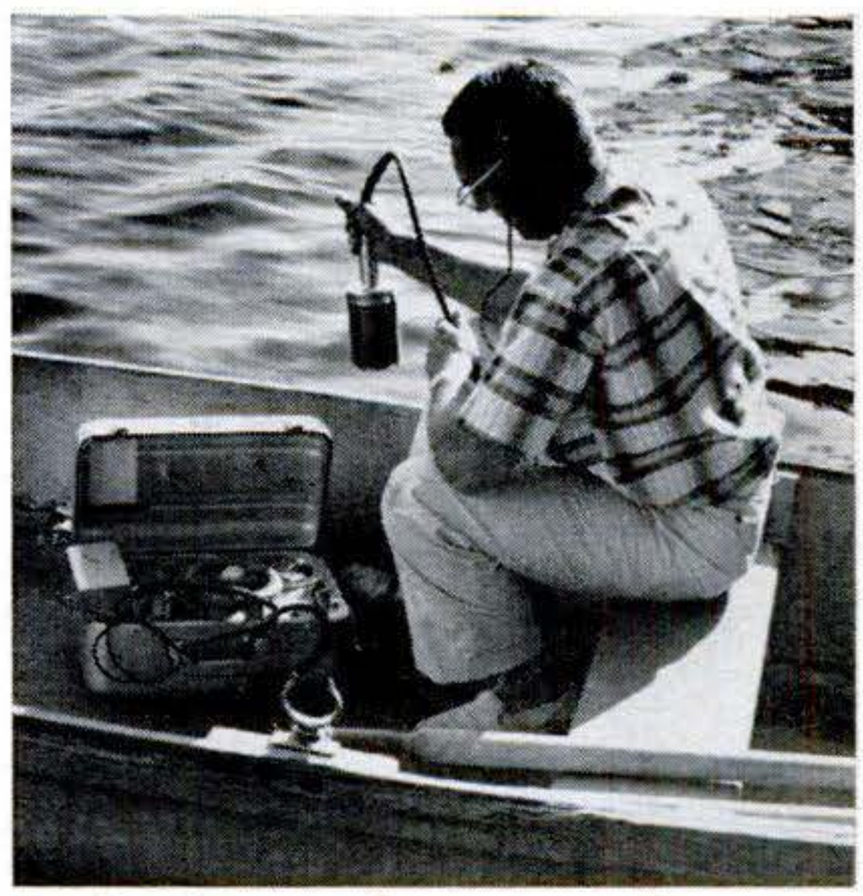
For clamor on a platter, sound engineer sets up equipment in a firehouse.



Hydrophone and tape recorder to put underwater sounds on the record.

This is the way you record the clatter of high heels on the pavement.

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Today's sound recorders are there to eavesdrop on anything

Handford thought others who loved railroading might like copies of the disc. He had some pressed, found that customers gobbled them up. He has issued some 30 albums of railroading records.

When Sid Frey of Audio Fidelity Records decided a few years ago that the time was right for steam-locomotive records in this country, he made a shocking discovery. He couldn't locate a single steam locomotive still chugging. A new Orleans railroad executive saved the day: He resurrected an old steamer, got it back into running shape.

Authentic as an iron rail. Frey mounted stereo mikes alongside the tracks. The result is breathtaking. You duck when the iron horse gallops by.

Sports-car racing fans are well taken care of, too. In 1956, Bill Grauer of Riverside Records fitted out an old bus with recording equipment, took off for the Sebring races in Florida. The record that resulted was a sensation. It sold so well that Grauer launched into a series of automobile records.

You can buy the recorded sound of almost anything that makes a noise: World War I airplanes, fire engines, motorcycles, air hammers. One company recently issued a disc called "Firepower" that captures the sounds of jet planes, missiles, bombs, and cannon. But the last band is a show stopper: It's the sound of an atom-bomb explosion.

Many early recordings of offbeat sounds didn't begin as gimmicks to sell records. One of the first, in fact, was deadly serious. During World War II, the Navy installed a complex network of hydrophones – underwater microphones—along the East Coast to spot enemy submarines. One day during the summer of 1942, listeners at the mouth of Chesapeake Bay were startled to hear a weird, clamoring, thunderous croaking in their earphones. Was it a new Axis trick to jam the hydrophones? Or could it be something even more sinister?

Then one officer had an idea. He loaded a small launch with a depth charge, rode out into the bay, and hustled the explosive over the side.

Listeners on shore heard the muffled boom—then silence. A few minutes later there was a cautious croak, then another, finally a swelling chorus. Within minutes, the aquatic cacophony had resumed bedlam proportions. The fish causing the noise—later identified as croakers—had been momentarily frightened into silence by the explosion.

Scientists at the Scripps Institute of Oceanography in California, hearing of the experience, began dropping their undersea microphones into the water. They recorded sounds and, where possible, connected them to specific underseas creatures. From this work—and subsequent recordings made by the Navy and the Florida State University Oceanographic Institute—came a number of discs available in record stores.

Most sound records on the market are recorded "straight"; the recording engineer simply finds the sound he wants, sets up a microphone, and turns on the tape. But it wasn't always that way.

Mikes without birds. Before the invention of the tape recorder, scientists frequently took a truck load of equipment weighing tons into remote areas to record bird songs for scientific purposes. Even then, their efforts were often wasted. Birds rarely approach human activity; when they do, they don't sing.

Where to get offbeat recordings

Most of the records mentioned—and hundreds of others—can be found in Schwann's Long Playing Record Catalogue (you can consult one at any record dealer's) under the "spoken and miscellaneous" listing. Referred to in the article but not listed in Schwann's is:

Varmint Decoy Records—Wrightman Electronics, 2 West Dover St., Easton, Md.

Although scores of companies issue sound records, three of the most active you can write to for lists are:

Folkways Records, 121 West 47 St., NYC.
Riverside Records, 235 West 46 St., NYC.
Audio Fidelity, 770 Eleventh Ave., NYC.

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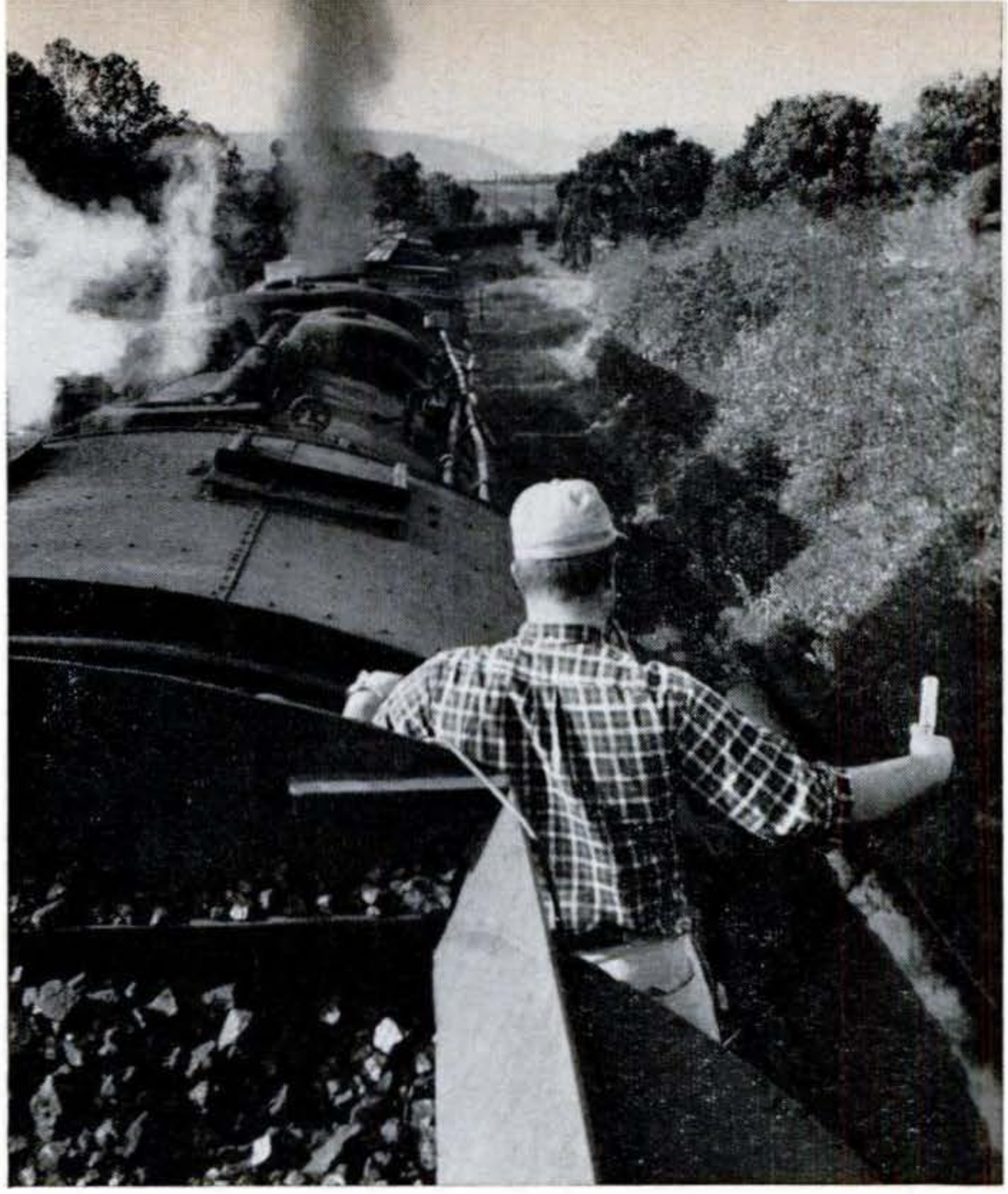
that makes a noise



Most-exciting train effects, recording experts claim, are obtained with the microphone some distance away (above). A good way to record locomotive sounds is to hold the mike as shown at right. The man's body absorbs unwanted rumbling from the train's rolling stock.

The breakthrough came in 1935 when Dr. Peter Paul Kellogg, pioneer bird recorder and Cornell University professor of ornithology, devised what is still the standard technique. Kellogg was in a cottage in Florida playing back some calls he had recorded, when a mockingbird showed up and started pecking at the window.

Kellogg put the speaker out in the yard and replayed the record. The bird hopped around it, trying to find the other bird. He finally gave up and tried to outsing the intruder. Kellogg flipped the speaker off, turned on a microphone hidden in the case, and proceeded to make a brilliant, close-range recording of a bird giving his all. Most bird recordings are now made with Kellogg's technique.

Although recording engineers usually prefer to get the mike close to the sound, it isn't always practical. When Dr. Charles Bogert of New York's Museum of Natural History records frog sounds, he frequently uses a portable parabolic reflector. This dishpan reaches out and grabs sounds many feet away, makes it appear that the mike is close even though it isn't.

Putting the jungle on tape. Sometimes producing a top-notch record is more complex. In 1951, New York's Museum of Natural History decided to set up a display of a South American rain forest showing the plants, birds, animals, and insects in their natural surroundings. To make the slice of jungle even more realistic, museum officials got in touch with Moses Asch, a recording expert, and asked him to supply background sound.

The museum already had recordings of some individual inhabitants of the jungle, and Asch was able to find a few others in private sound libraries. To fill out the roster, he spent weeks at the Bronx Zoo, recording birds and animals native to the Brazilian forest. Finally, he collected sounds of the breeze rustling through trees, an approaching storm, rain pelting down on broad leaves (made in a bathroom shower), and the singing of insects.

Asch consulted with jungle experts,

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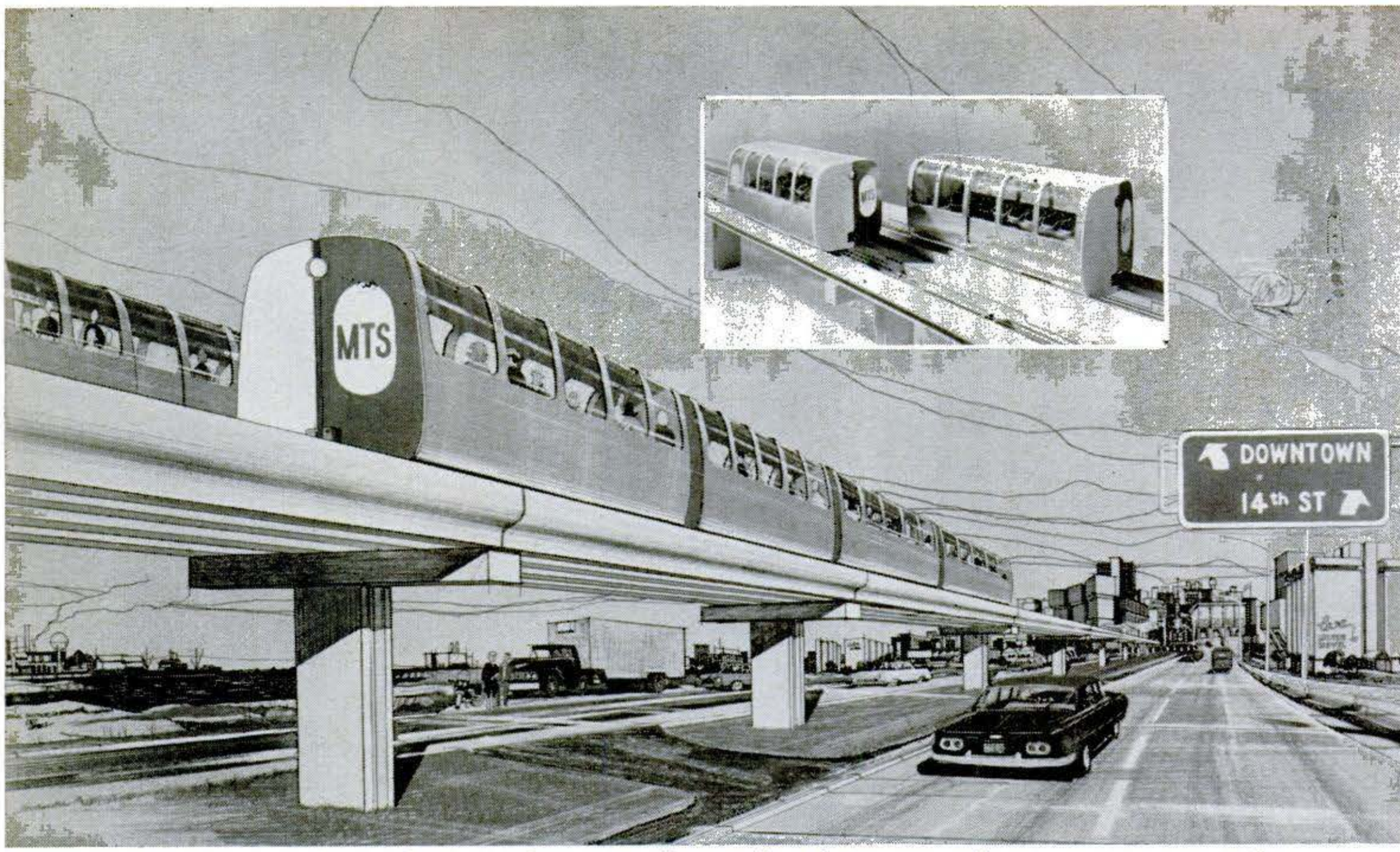


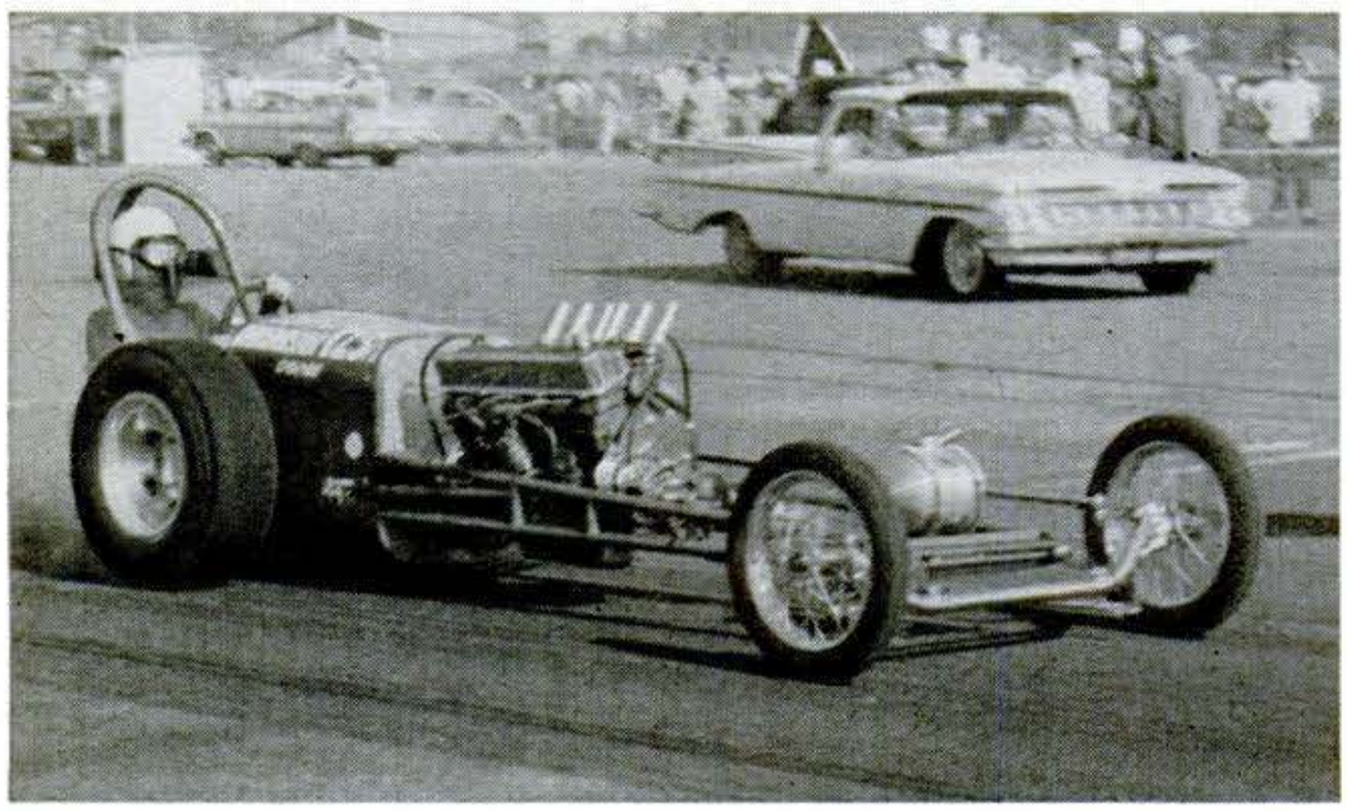
Automated trains are shown here in drawing operating on a double track over median strip of electrified express highway. Structure would be made of prestressed, precast concrete. In inset are models of bucket-seat aluminum cars, about a seventh the weight of typical rail cars.

Driverless train for low-cost rapid transit

A rapid-transit system, automated and trimmed to size for cities with populations of 500,000 to 2,000,000, has been designed by Westinghouse at the instigation of the city of Pittsburgh. Rubber-tired aluminum electric cars would carry 20 passengers each in individual bucket seats. Power would be drawn from cables in the floor of an overhead expressway having high curbings on which four horizontal wheels would guide the vehicles. Dual tires on both axles would prevent delays on account of a flat.

Cars would run singly during off-peak hours, in trains of up to 10 cars made up by punch cards in automatic switchyards during rush-hour operation. A central control computer, assisted by local controllers, would keep cars and trains at 50 m.p.h. on a two-minute headway, with automatic stops at stations spaced a mile apart. The system is designed to carry 5,000 to 14,000 passengers an hour in either direction.

With no motormen or conductors, labor costs would be reduced; with lightweight rolling stock, equipment would be comparatively inexpensive. Other possible users, says Westinghouse, are Atlanta, Baltimore, and San Francisco.



Six in a row for go

Successful six-cylinder dragsters are almost unheard of. But that didn't stop this Dragmaster, powered by a 225-inch Dodge Dart slant-six, from dusting off all V-8 competition and setting a new D/Dragster record.

Jim Nelson and Dode Martin of Carlsbad, Calif., added fuel injection, high-compression pistons, and racing camshaft. Best standing-start quarter-mile time: 126.22 m.p.h. in 10.64 seconds.

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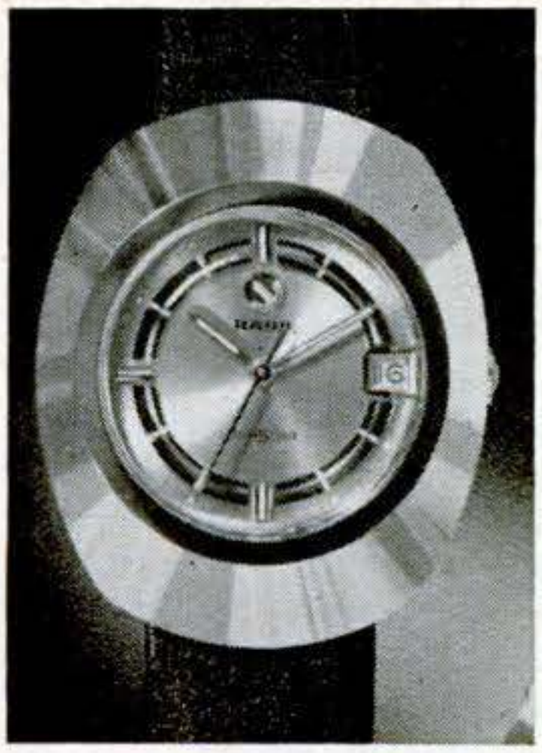
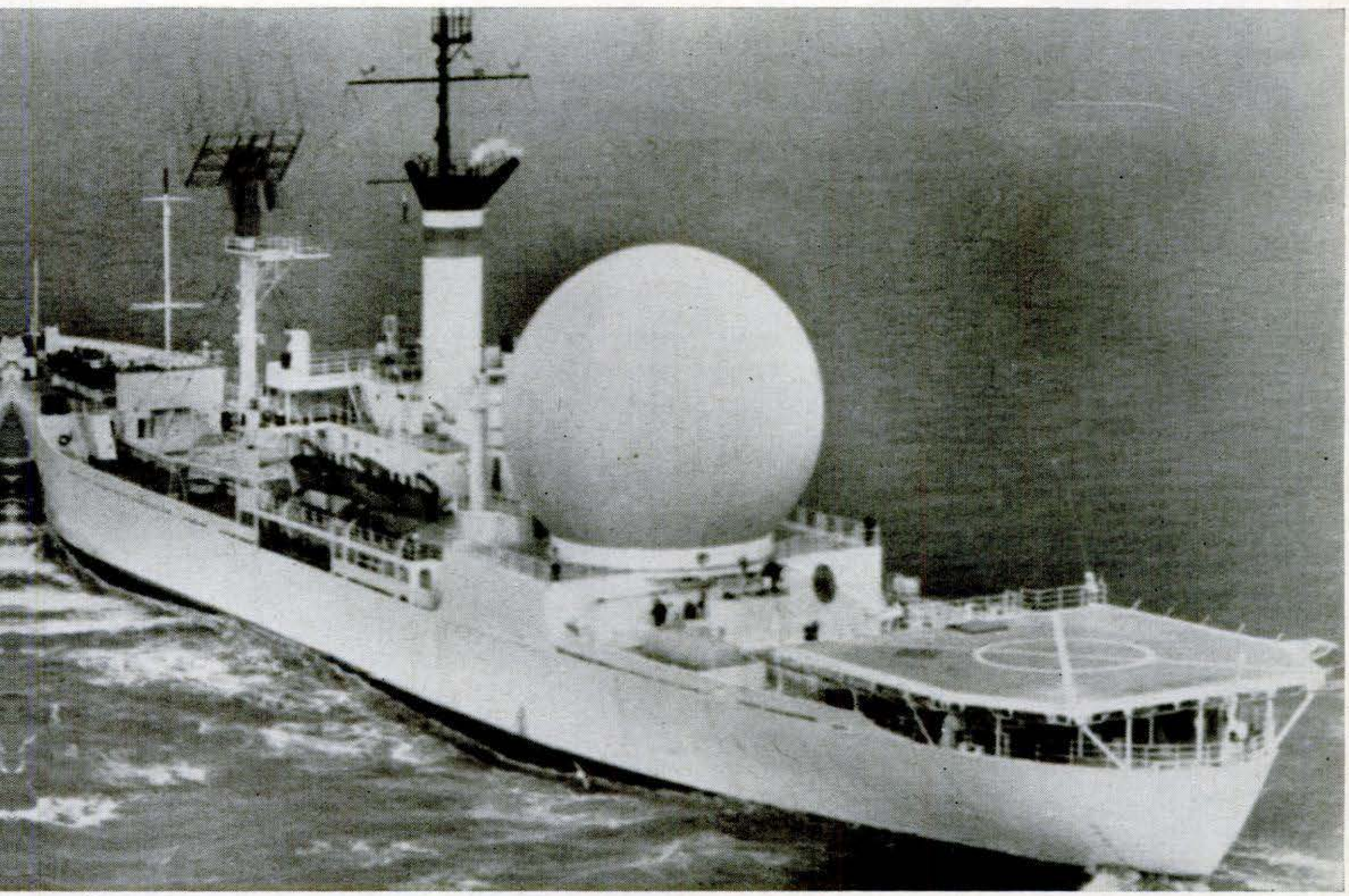


Scratchproof watch

Now the Swiss come up with a watch you can't scratch—either case or crystal. The Rado's new case is a superhard sintered alloy of powdered tungsten, cobalt, and nickel. It looks like chrome, is harder than stainless steel, twice as hard as gold. The crystal is synthetic sapphire – almost as hard as a diamond.

Crank-operated emergency service

At every mile on a test stretch of New Jersey's Garden State Parkway, motorists in trouble can radio for help. A call box (right) sends an SOS with a spin of a hand crank. If you turn an indicator switch to the right, you'll get a repair truck, to the left an ambulance.



Converted Navy ship talks to satellites

The first seagoing satellite-communications center has been unveiled by the Navy. The floating terminal is the reconverted naval cargo vessel Kingsport, assigned to the Army for testing transmission and reception of space messages. It will be used in addition to two 60-foot antennas (at Fort Dix, N.J., and Camp Roberts, Calif.) and a flying unit in a plane based at the Naval Air Station at Lakehurst, N.J.

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Round-the-clock watch over vessels at sea is maintained at Coast Guard's RCC on Portsmouth waterfront. Facing floor-to-ceiling charts and ship-status boards, controllers like Lt. Richard N. Wescott (back to camera) sweated out the hours playing a giant game of checkers with the sea, with ships for markers. In photo at right, the broken-off bow of the tanker Gem still rides the waves after the storm.

The Coast Guard's Worst Week

By Richard Petrow

What happens when the Coast Guard runs out of rescue ships

EARLY in March, 1962, a storm of awesome destructive power slowly built up a head of steam far out in the Atlantic, then struck without warning. Vessels plying the coastal sea lanes were hit by 50-foot waves and hurricane-velocity winds.

For the Coast Guard, it was the start of "the worst disaster period—in scope and duration of rescue operations—in recent history." Nowhere was the storm's power more evident than at the Rescue Coordination Center in Portsmouth, Va., where a small team of controllers struggled to prevent the sea from engulfing ships and men.

In such a contest, it is always the sea that lays down the rules, and she frequently calls the shots.

At 7:47 a.m., Wednesday, March 7, the clattering of the teletype at the 5th Coast Guard District Rescue Coordination Center was the opening whistle. It carried news of the first of four major distress cases. All four would have to be handled simultaneously during the next 33 hours from Cape Fear to the Delaware Breakwater.

Coast Guard radio operators at Norfolk had picked up the distress call and passed it on by teletype to RCC: TANKER A. H. DUMONT CALLED AND REPORTED HER POSITION 37.20 NORTH, LONGITUDE 71.20 WEST. SHE HAS DECK CARGO, HEAVY TRAILER AND TWO HUGE GENERATORS, AND TWO HEAVY ANTENNAS, AND IS ON SPECIAL ASSIGNMENT. SHE STATES TRAILER HAS BROKEN LOOSE AND REQUESTS CG UNIT STANDBY IN CASE OF EMERGENCY, AND KEEP SPECIAL GUARD ON 2182 KCS.

In the RCC, Lt. (j.g.) David Zwerner hastily checked *Lloyd's Register of Shipping*. It listed the Dumont as a 215-foot tanker. Then he turned to his charts.

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—with four vessels in trouble and a tanker split in two?

By plotting her reported position, he placed the ship 240 miles east-northeast of Norfolk.

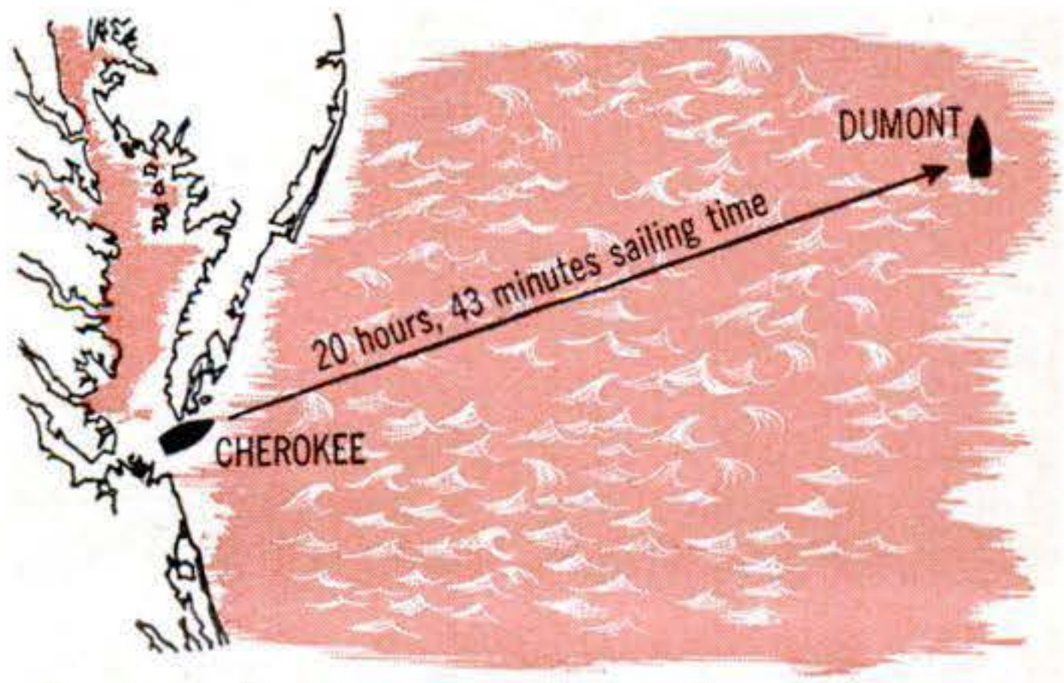
The radiomen would guard the 2,182-kilocycle distress frequency, but he'd have to send a rescue vessel.

Zwerner chose the Cherokee, a tough, 205-foot, ocean-going tug, then off the entrance to Chesapeake Bay on search-and-rescue patrol.

The Cherokee, a veteran of many offshore rescues, is not the fastest vessel afloat. But what she lacks in speed, she makes up in doggedness. She set course for the Dumont, reporting to RCC: PROCEEDING MAX POSSIBLE SPEED. ETA 080430R. WX VERY HEAVY NE SWELLS SEA FROM NNE 25 FEET WIND NNE GUSTING 40 TO 60 MPH BARO 29.74.

ETA is estimated time of arrival, and the Cherokee had given this as 4:30 a.m. on the eighth.

SOME 240 miles away, the Dumont was plowing through gigantic seas toward New York. The National Aeronautics and Space Administration had



chartered it several weeks before, installed special electronic gear, and sent her to take position south of Bermuda. Her mission: to track rockets from Cape Canaveral. Unfortunately for the Dumont, she started home just as the storm was gathering force . . . and wandered

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into the center of it. When the Cherokee started to her rescue, the Dumont was in plenty of trouble. A large trailer had ripped loose and was lumbering back and forth across the deck.

AT 8:00 a.m., Wednesday, March 7, the situation was this: The Dumont a possible distress; the rescue tug Cherokee en route to her aid; weather terrible; seas mountainous. Overall evaluation: situation better than could be expected.

It was not to last.

Sixty miles due east of Cape Hatteras the 455-foot-merchantman Chun Lee was wallowing through mountainous waves. Capt. Ru Ling Day—34 years in the Chinese merchant marine—was on the bridge as his ship plowed north.

Captain Day had brought the Chun Lee across the Pacific without incident. He had eased her through the Panama Canal, stopped at Houston, skirted Key West, and headed north, putting plenty of salt water between him and Cape Hatteras.

Between 9:00 and 10:00 a.m., Wednesday, the storm hit him. Walls of water came crashing over the Chun Lee's deck, flooding the steering-engine room. The hydraulic steering-gear motor sputtered to a stop. A wave smashed seamen against the deck. In the engine room, men bounced against the bulkheads like Ping-pong balls. Waves splintered four of the ship's five lifeboats.

At 10:10 a.m., Captain Day wrote out a terse message—in Chinese. His English-speaking radioman got it out fast: SHIP OUT OF COMMAND. IMMEDIATE ASSISTANCE REQUESTED.

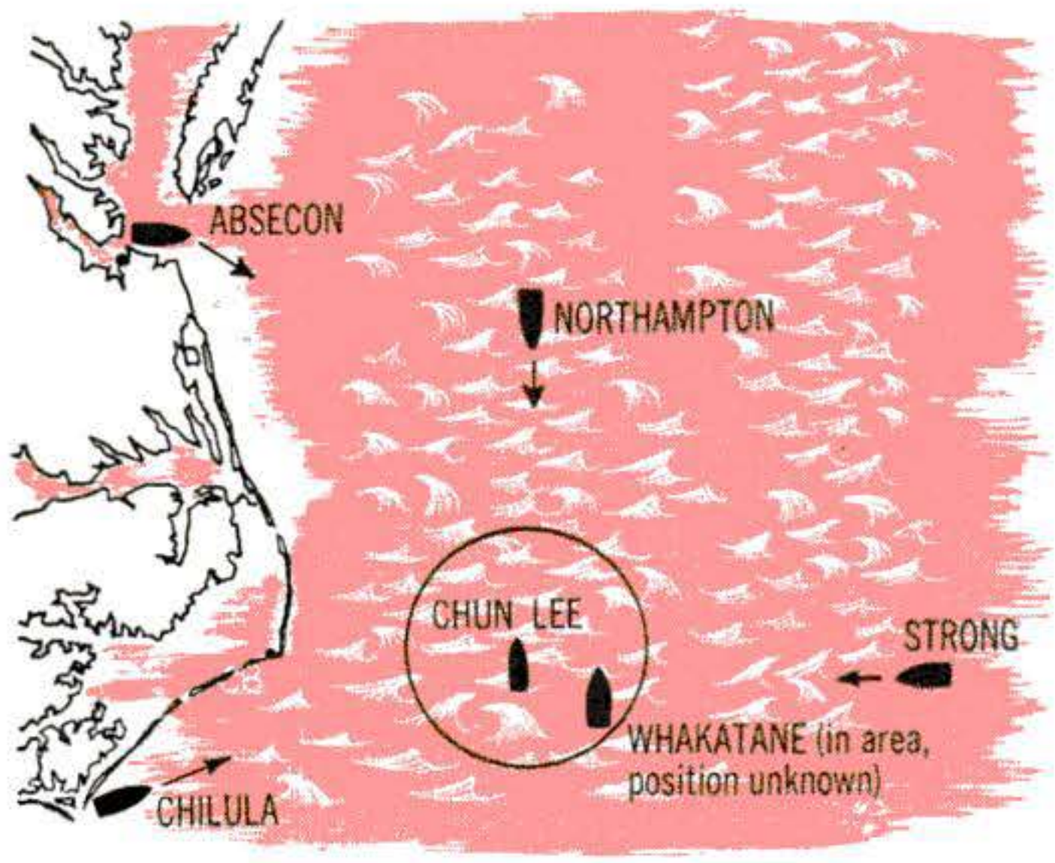
The sleek, 310-foot cutter Absecon got ready for sea in 90 minutes and raced from Norfolk. The Coast Guard tug Chilula left Morehead City, N.C. The Navy destroyer Strong, already at sea, was diverted. So was the command cruiser Northampton, 88 miles north of the Chun Lee.

None of these vessels was near enough to offer quick assistance. But there was another trick in Controller Zwerner's bag. He picked up the phone and called the Coast Guard in New York. "I'll need a 'surpic' fast," Zwerner said. "I'll hold the line."

Headquarters for Commander, Eastern Area, is responsible for keeping track of merchant ships plying the Atlantic—the "surface picture" (surpic).

All ships are supposed to report position every eight hours. When they do, round markers are moved on a giant chart of the Atlantic. When they don't, the markers are moved anyway—by dead reckoning.

Comeastarea reported the SS Whakatane, a 472-foot British freighter, the closest vessel (by the chart) to the Chinese ship. Zwerner started writing: TO THE MASTER SS WHAKATANE. YOUR VESSEL CLOSEST KNOWN VESSEL TO CHUN LEE. REQUEST YOU STANDBY FOR POSSIBLE LATER ASSISTANCE.



AT 1:00 p.m., Wednesday, the situation was this: The Dumont still a possible distress; the Cherokee going to her aid. The Chun Lee out of command; a small flotilla bucking the seas to reach her. In five hours the situation had worsened, and this was only the beginning.

All through the daylight hours of Wednesday, the wind kept rising, and foaming white seas boiled to new heights. In the Fifth District RCC on the Portsmouth waterfront, the teletype kept up a steady flow of messages. Near dusk, hell really broke loose. The first hint of what was in store came from the Cherokee.

At 4:00 p.m. she was on a course of 060 degrees, speed of advance eight knots

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—making for the Dumont. Lt. Cmdr. Preston Bannister, her CO, was on the bridge.

His ship was fighting a primary swell with waves up to 30 feet, coming from due north. The Cherokee was taking the primary on her port bow. A secondary swell from east-southeast was cross-bucking the primary.

Suddenly the secondary climbed to top the primary. A wall of water 50 feet high rose parallel to the Cherokee's starboard side. Bannister felt it hit "like an A-bomb." His ship shuddered and skidded sideways. By the time forward motion resumed, damage reports were coming to the bridge.

The engine room reported water coming down the skylight onto the main switchboard. If the switchboard grounded out, the ship would be dead in the water.

The master of arms reported a foot of water in the crew's berthing compartment and more water coming through every second.

Looking aft, Bannister saw that his number-one lifeboat had been stove in. Several life rafts were floating away.

Bannister ordered an inspection aft. His first lieutenant, Ens. George Gaul, head lowered, inched his way aft. He came back with black news.

All lifesaving equipment was gone. And 450 feet of hawser that had been lashed down on the fantail had been washed overboard.

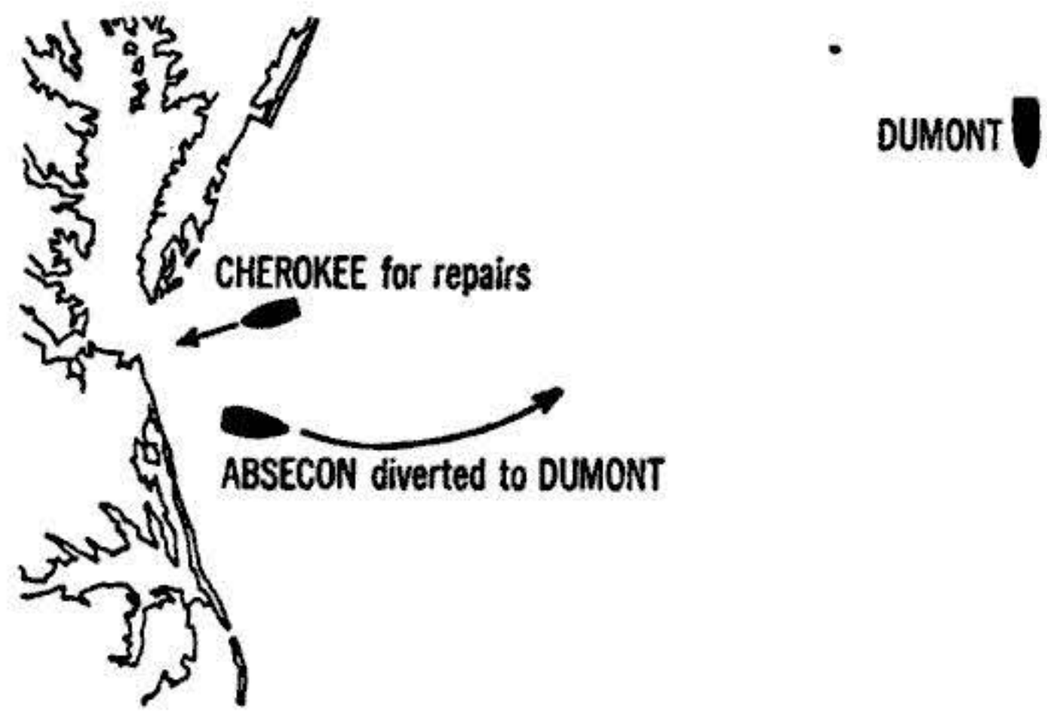
"The hawser is wrapped around our propeller," Gaul reported. "It could seize any minute."

Bannister grabbed for the ship's telegraph, got through to his engineer. "All possible speed," he ordered. "Under no circumstances stop or reverse the engines."

The Coast Guard has a motto: "You have to go out, but you don't have to return." Bannister was in command of a ship in danger of losing all power in a killer storm. He was responsible for the lives of 74 men—and his ship was without lifesaving equipment.

On the other hand, he could still make headway, and the Dumont *could* be in worse trouble.

It wasn't an easy decision. He knew that four merchantmen were by now talking to the Dumont and that she still wasn't reporting herself in immediate danger. With reluctance, he radioed the Fifth District: REQUEST PERMISSION TO RETURN CAPE HENRY TO ATTEMPT CLEAR LINE FROM WHEEL AND EFFECT REPAIRS. CONDITIONS MAKE HEAVING NOT FEASIBLE.



THE Cherokee limped off at 5:30 p.m. That left the Dumont uncovered. Solution: Divert the Absecon from the Chun Lee—the Navy or the Whakatane could aid the Chinese freighter.

Within the hour, the Dumont—up to then only a potential emergency—started screaming that she was in serious trouble. By then, she was hove to and trying desperately to get her loose deck cargo under control. Suddenly the bells started clanging on the bridge. From deep in the ship came an excited voice.

"Captain! The rudder-post bolts are popping."

If the rudder became inoperative, the Dumont could capsize within minutes. Captain Hutchinson advised the Coast Guard: TIME OF ARRIVAL OF CHEROKEE TOO LATE. WON'T LAST UNTIL 0300.

What the worried captain didn't know was that the Cherokee wasn't coming. The Absecon was now en route to him with an ETA much later than 3:00 a.m. Thursday. The Dumont could go down before help arrived.

AT 5:45 p.m., Wednesday, the RCC again took stock: The Dumont believed sinking with 13 officers and men

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on board; the Chun Lee not yet reached; the Cherokee, semi-invalid. Even the Chesapeake lightship, normally anchored 30 miles off the Virginia Capes, was off-station, blown away by the high winds.

Lt. (j.g.) Bruce Willis, RCC duty officer, had barely time to digest this when the chief radioman rushed in with more word from the lightship. She had been hit, hard.

Warrant Officer Warren Barrett, in the pilot house of the 133-foot lightship, had seen the blow coming. Four other men in the pilot house heard him shout: "Hit the deck!" A split second later a mountainous sea smashed the pilot house, sending glass flying at shoulder height into the rear bulkhead.

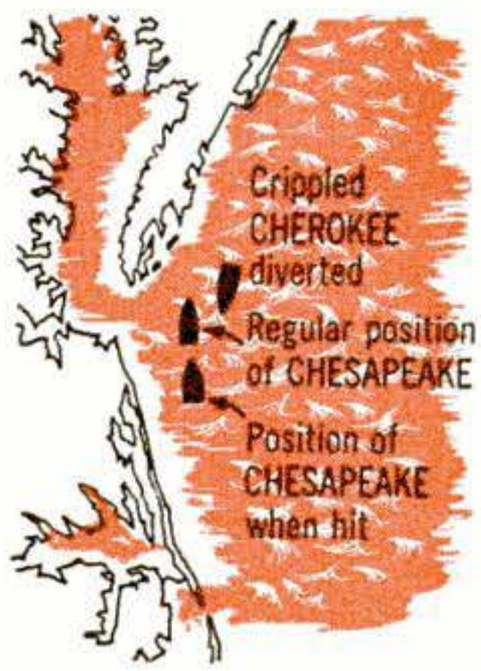
The wave's impact knocked helmsman Robert Patton down a metal ladder and buckled the forward bulkhead. Water rushed down into the hold, grounding the electronic navigation.

In the pilot house, Barrett found himself sitting in chest-high water. Three feet of water sloshed in the engine room. But the radio was still working. They got through to Portsmouth.

"Do you have to abandon ship?" controller Willis wanted to know.

"Don't know," Barrett replied. "But need immediate assistance."

WILLIS quickly checked for the vessel closest to the battered lightship. It turned out to be the last one he would want for such a job—the Cherokee. But there was no choice; crippled or not, the Cherokee had to go to the assistance of the lightship.



At Portsmouth, Lt. Richard Wescott was duty officer in charge on the midnight-to-eight shift, Thursday, March 8. It was a watch to remember.

At midnight, Wednesday, the situation was ominous: The Dumont believed sinking; no assistance at scene. The Chun Lee still in trouble; no assistance at scene. The Chesapeake drifting south, and in extreme danger; the Cherokee limping to her assistance.

Things were comparatively quiet for more than four hours. At 4:38 a.m. distress bells started ringing again, and a cryptic message was thrust into Wescott's hand: FROM RADIO STATION NORFOLK, 27TH MESSAGE OF DAY (and the day less than five hours old!). FOLLOWING RECEIVED 500 KCS (primary distress frequency) FROM OUZX (call letters of 390-foot Danish vessel Jytte Skou) AT 4:15 A.M.: OBSERVED PRESUMED DISTRESS CANDLE LIGHTS COLOR RED OR ORANGE IN APPROX POSITION 33-56N 75-12W (about 140 miles east of Cape Fear). MASTER OUZX.

Lt. Wescott glanced at his wall chart and answered the skipper: NO REPORT OF DISTRESS THAT AREA. REQUEST YOU INVESTIGATE AND ADVISE.

Within minutes, the Dane reported back. He had sighted a "blacked-out vessel," but its distance was too great for identification.

Wescott wrote out a two-word instruction: ATTEMPT IDENTIFY.

THE Jytte Skou complied, cautiously making her way towards the blacked-out vessel. It was early dawn. Visibility was poor. But as the distance between the ships decreased, an eerie feeling of something wrong grew on the men standing watch on the Jytte Skou. When the picture cleared, they saw a sight rivaling the horror of fire at sea.

What the Jytte Skou found riding those killer waves was not a blacked-out vessel, but the bow section of a large ship that had been snapped in two.

It was the ill-fated tanker, Gem. But the Dane reported: STILL UNABLE TO IDENTIFY VESSEL. IT IS A TANKER. SHIP BROKEN IN TWO. SIX CREW MEN VISIBLE ON BOW. STERN NOT VISIBLE.

When Wescott read the message, his mind refused to accept the four astonishing words tucked into the middle of the sentence. With a vessel broken amidships, he had a distress of major

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magnitude on his hands. And what of the men in the stern? Back to the Jytte Skou went this message:

REQUEST YOU STANDBY AND ASSIST AS ABLE. ADVISE WHERE BREAK OCCURRED NUMBER OF PERSONNEL ON BOARD AND IF REMAINING PERSONNEL SAW OTHER PORTION SINK.

Wescott, while hoping for the best, obviously was not discounting the worst.

When a ship breaks apart it is usually the larger section that remains afloat; the smaller section sinks. The Jytte Skou had found the bow afloat. It followed that the missing stern probably had been the smaller section.

The fact that the ship was a tanker made things look even grimmer. Crew quarters on tankers are in the stern. If the stern had sunk, it had probably taken most of the crew.

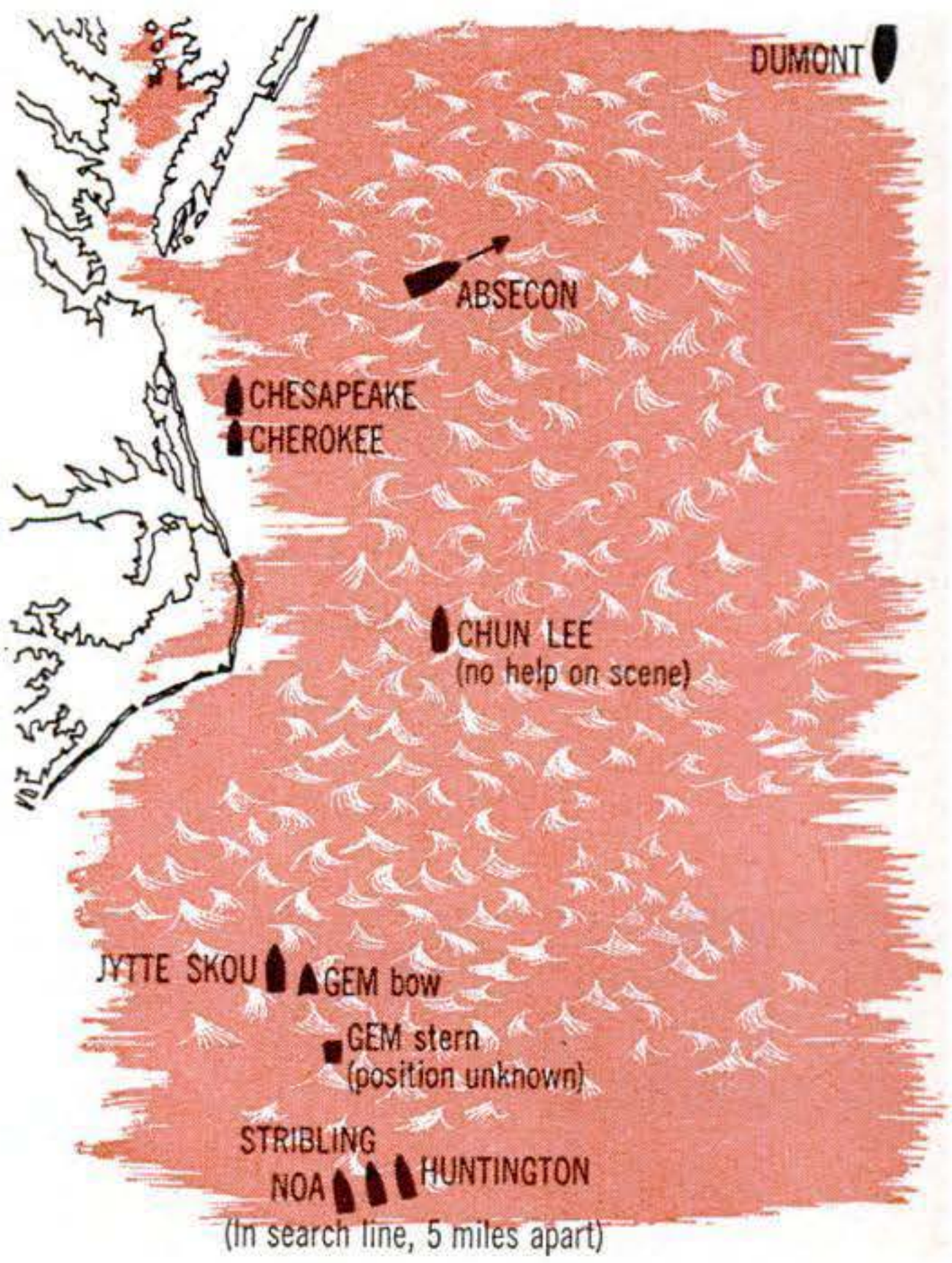
By early morning, Cmdr. Vance K. Randle was taxiing his four-engine search plane to the end of the long runway at Elizabeth City (N.C.) Air Station. His mission: find the missing stern of the Gem—if it was still afloat. The Lockheed Hercules was airborne at 6:45.

At Portsmouth, Wescott faced his status board. A glance showed that he had nothing to send to the scene of the disaster. The Coast Guard had run out of ships. It was now up to the Navy. Three destroyers, the Noa, the Stribling, and the Huntington were ordered out.

The destroyers would take some time to get there, but the Jytte Skou was standing by the sinking bow of the tanker, finally identified as the Gem. At least that was how it looked until this message came in: DUE TO CONDITIONS OF JYTTE SKOU IN BALLAST REMAINING ALONGSIDE THE GEM IMPOSSIBLE SHIP MUST PROCEED AGAINST THE HEAVY SEAS AND SWELL AS THE TURNING OF JYTTE SKOU TOO DANGEROUS TO OURSELVES MASTER.

AT 7:00 a.m., Thursday, March 8, the situation was this: The Dumont was still in trouble; no aid on scene. The Chun Lee was attempting repairs to her rudder; no help on scene. The lightship Chesapeake was under her own power; tug Cherokee standing by. And eight men were riding the Gem's bow, with the only ship at hand incapable of helping. Finally there was the doubt about the stern. With luck, it might still be floating—helplessly, position unknown.

There was one happy note. The Dumont, which had reported she couldn't stay afloat until 3:00, was still sending out a stream of messages. But by now the outline of the Dumont picture was getting fuzzy.



ON the bow of the Gem, Capt. Karl Heinmaa, an Estonian seaman living in Canada, and Second Mate Kjelle Bamberg, a Norwegian who lived in Brooklyn, conferred on what to do. There were six men with them.

Their 501-foot, molasses-laden tanker had sailed from the Dominican Republic for New York. For two days heavy seas and high winds had pounded her. The big blow struck at 7:15 p.m., March 7. Heinmaa heard a big crash that "sounded like rending of metal." He dashed outside the pilot house—just in time to see the stern section fade away into the storm.

For a few terrifying minutes, as the

[Continued on page 214]

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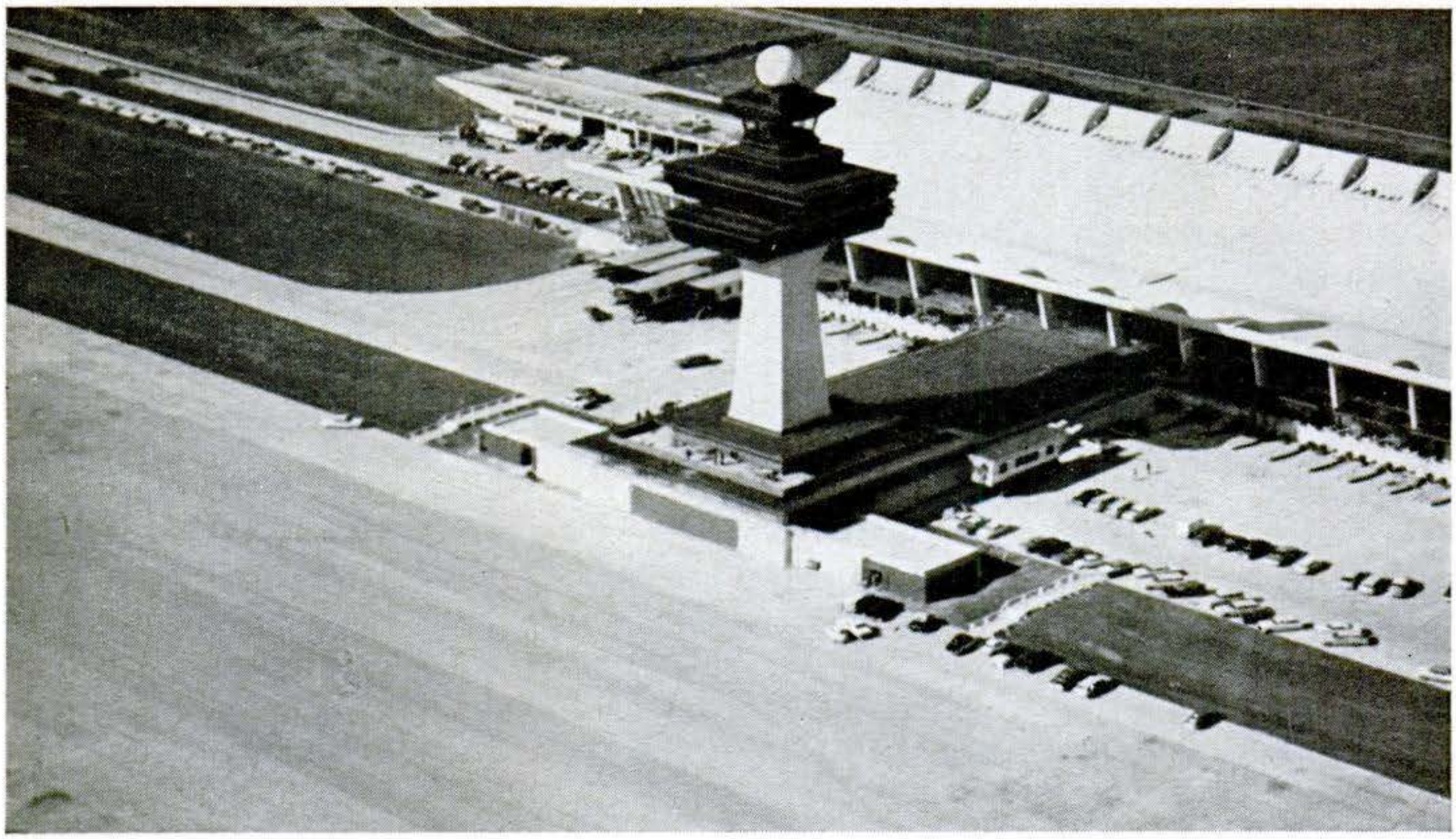
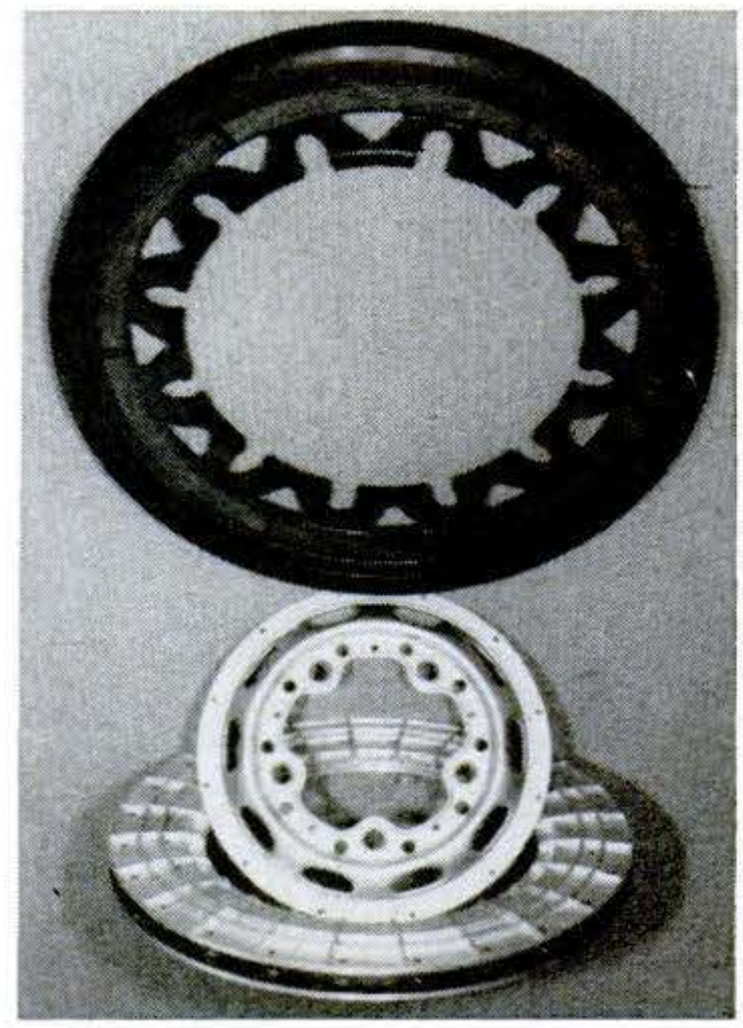


First U.S. jet-age airport opens near nation's capital

The main terminal building at Dulles International Airport, Chantilly, Va., 27 miles from Washington, has no "fingers" for loading and unloading passengers. Instead, they ride mobile lounges [PS, Sept. '59] to and from jets parked on the plane service apron in foreground above. One is shown just to the right of the pagoda-like control tower, several on the other side. Major runways are 2¼ miles long.



Rubber-sprung center deflects up to two inches (above), consists of metal-braced solid tire (right), zigzag of rubber springs, alloy flanking disk, and press-formed center section.

Spare wheel has built-in springs

This two-inch-thick spare wheel weighs 40 percent less than a standard wheel and, with further development, says its German inventor, Leopold Schmid, could replace all four wheels for all-around use. Its sprung center would enable it to eliminate chassis suspension, reduce unsprung weight, and lower manufacturing costs. And since the wheel cushions the ride, solid rubber tires are used.

The wheel has been tested at 100 m.p.h. Schmid believes it is ideal for ultra-high-speed driving because of its low rolling resistance, thin profile, puncture-proof tread, and freedom from centrifugal force. He plans to build a race car, to prove it.

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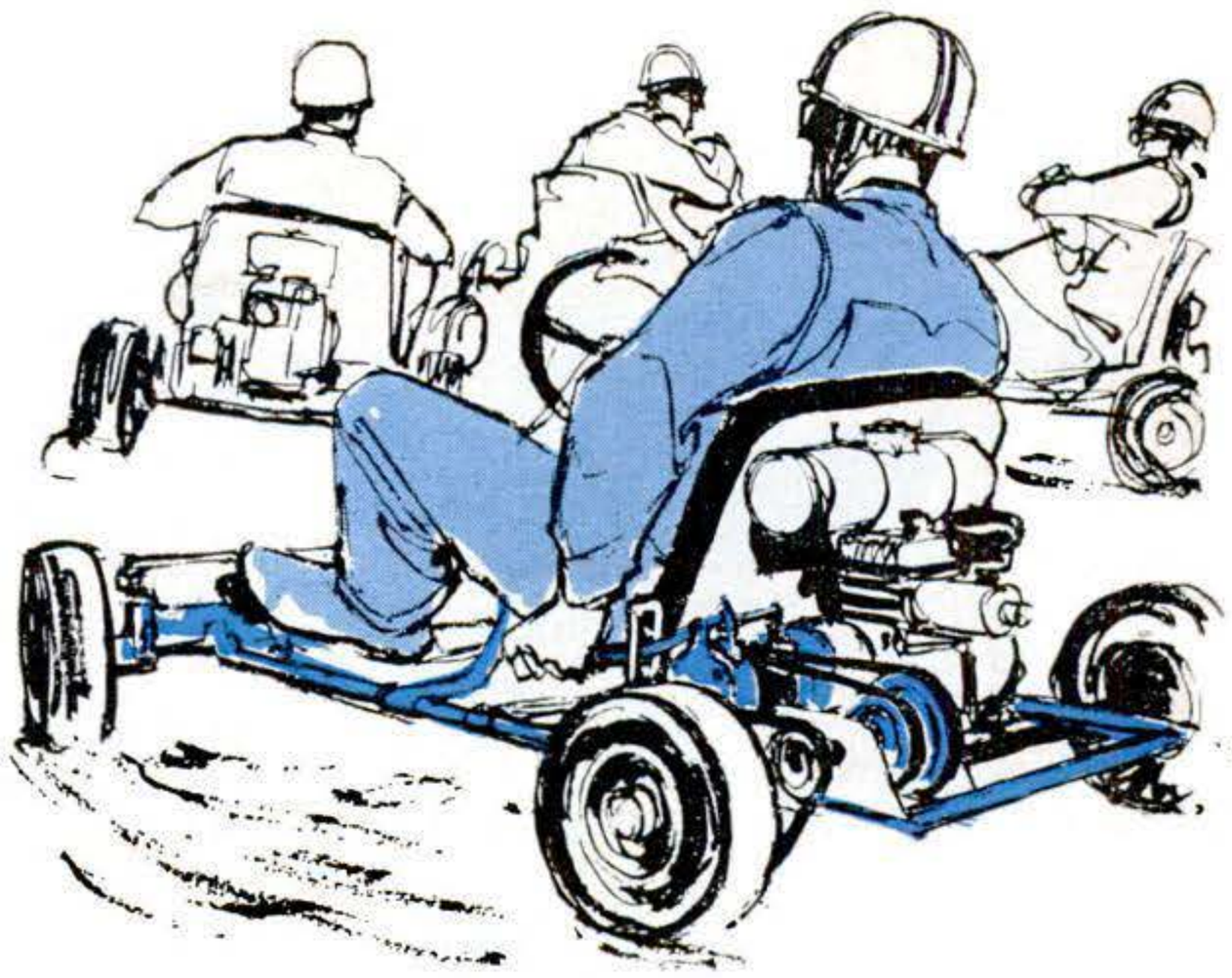
"I'd like to see them make..."

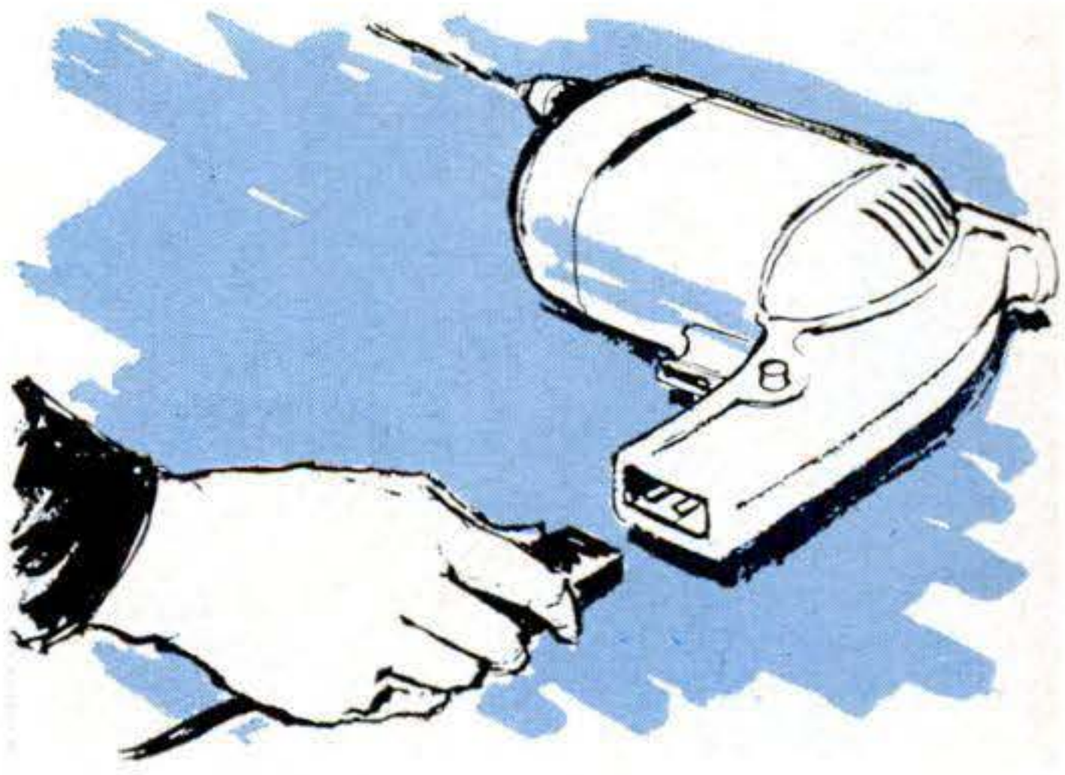


For better karting, a quick-change gear reduction for the clutch so you could make changes for speed, power, or track variations quicker, easier, and cheaper. —*Gary Pittman, Independence, Pa.*

Stubbier paint cans to provide a broader mouth for wide brushes. Cans with more diameter than height wouldn't tip over easily, either.—*Donald Nauman, Caledonia, Minn.*

Gummed-paper reinforcements with a slit at one side. Then you could repair loose-leaf pages without removing the sheets from the book.—*J. M. McPhee, Braintree, Mass.*

Foil-packed frozen dinners with a heater element in the bottom. A hunter or workman would clip a cord from his car's lighter socket into leads.—*R. Marie, Hagerstown, Ind.*



Built-in sockets on portable power tools. Cordless, they'd be easier to store; and one cord, bought separately, would serve all your electric tools.—*V. W. Rogers, Sunnyvale, Calif.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 17. Write your name and address clearly. Contributions cannot be acknowledged or returned.

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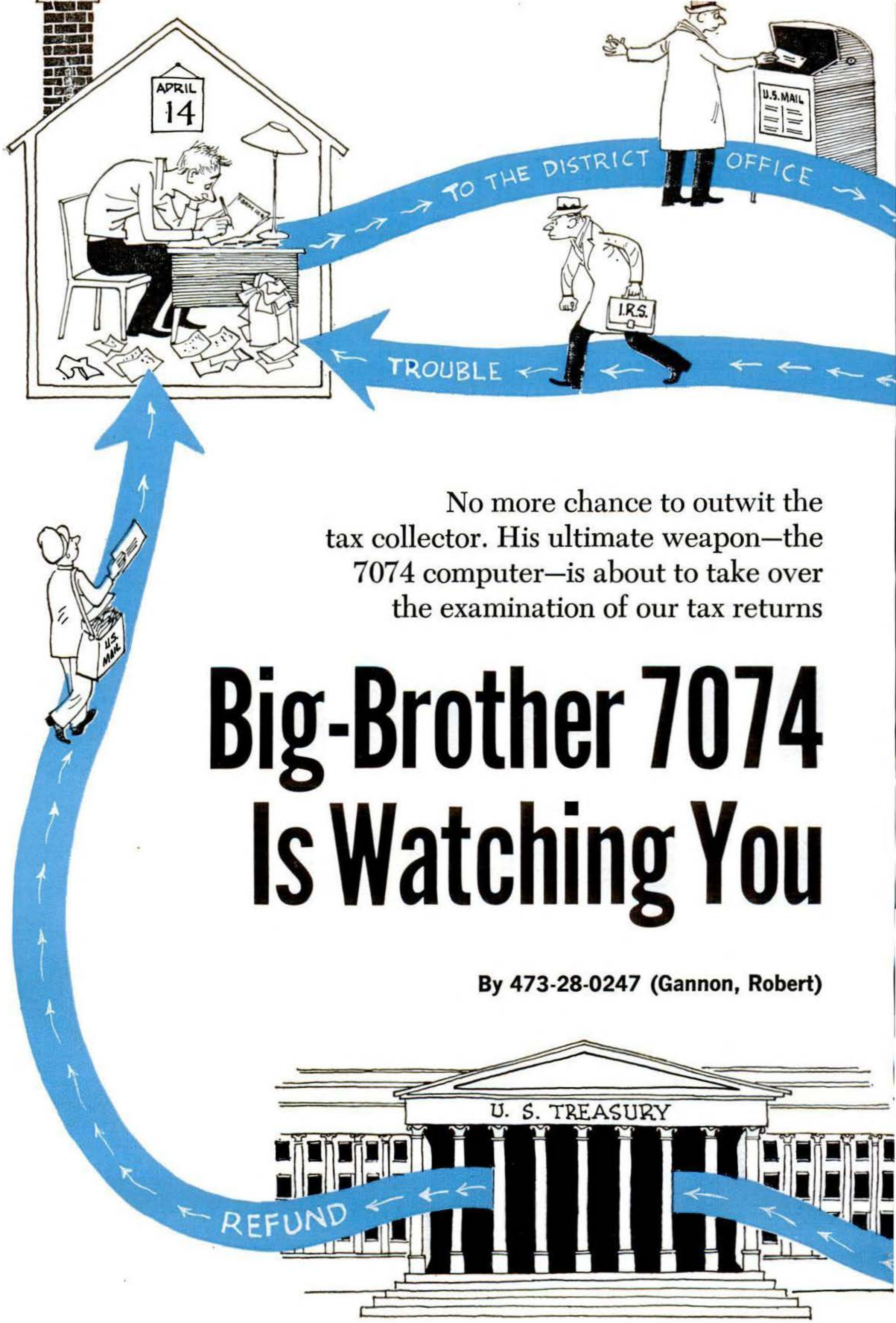

No more chance to outwit the tax collector. His ultimate weapon—the 7074 computer—is about to take over the examination of our tax returns

Big-Brother 7074 Is Watching You

By 473-28-0247 (Gannon, Robert)

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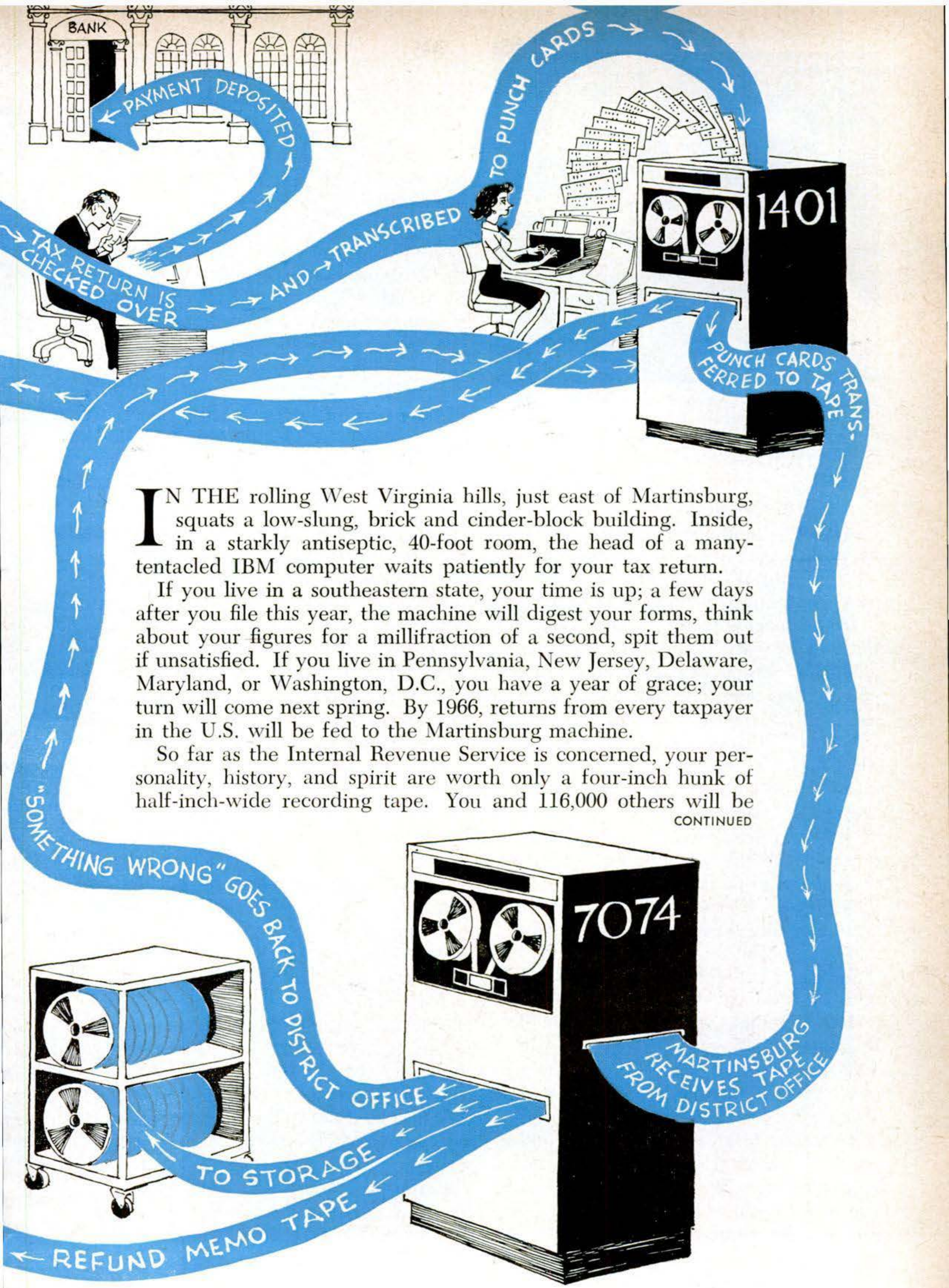

IN THE rolling West Virginia hills, just east of Martinsburg, squats a low-slung, brick and cinder-block building. Inside, in a starkly antiseptic, 40-foot room, the head of a many-tentacled IBM computer waits patiently for your tax return.

If you live in a southeastern state, your time is up; a few days after you file this year, the machine will digest your forms, think about your figures for a millifraction of a second, spit them out if unsatisfied. If you live in Pennsylvania, New Jersey, Delaware, Maryland, or Washington, D.C., you have a year of grace; your turn will come next spring. By 1966, returns from every taxpayer in the U.S. will be fed to the Martinsburg machine.

So far as the Internal Revenue Service is concerned, your personality, history, and spirit are worth only a four-inch hunk of half-inch-wide recording tape. You and 116,000 others will be

CONTINUED

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A snip of tape four inches long and a half-inch wide holds all the information the tax man needs to know about you. It will speed refunds to the honest taxpayer, put the finger on cheats.

reduced to magnetic specks on a single reel about the diameter of an LP record. Data on every taxpayer in the country will fit into a living-room-size storage rack containing 500 miles of tape.

If your accounts are straight, you have nothing to worry about. You may even get your refund check sooner. But if you're someone who forgets, fakes, or fouls up the forms, you're in for trouble.

When I visited the computer center recently, what hit me strongest was the aura of no-nonsense efficiency around the place. There were no rows of desks, no papers piled eyebrow high. Hardly a paper at all, in fact, for tax forms are transferred to recording tape long before they get to Martinsburg. Missing, too, were clacking typewriters, blowing fans, clerks gabbing around the coffee machine. The only sound was the relentless whirring and clicking of IBM's 7074.

The machine itself costs $1,200,000, but Internal Revenue rents it for about $4,000 a day. At this price, the government runs the computer night and day, seven days a week. 7074 never rests.

Seated in his gleamingly efficient office, John E. Stewart, Director of the National Computer Center, told me that when the program was first announced, people all over the country, figuring the jig was up, streamed into tax offices to confess past sins. Some were remarkable. At one office, a man turned in his 80-year-old mother. Said she hadn't filed her tax return yet. Ever.

According to Internal Revenue Chief Mortimer M. Caplin, more than $700,000 has so far been voluntarily turned in by guilt-ridden taxpayers.

Automatic Data Processing (ADP) promises, strange as it seems, benefits to the taxpayer as well as to the government. Here's how you'll profit, according to tax authorities:

- Because the bulk of cheaters (both individuals and businesses) will be caught, the system will insure "the fairest distribution of taxes in the history of man." You'll be sure that the guy down the street isn't getting away with something you aren't.
- Last year some 50,000 refund checks were undeliverable because the owners had moved from one district to another. Now this won't happen; the central computer will keep track of where you are.
- The computer will even notice those rare instances where a taxpayer *overpays* —not too often pointed out before.
- The machine will free thousands of employees to give you more "personal service." Translated, this dubious benefit means more face-to-face tax collectors.

Not surprisingly, benefits to the IRS are even more plentiful. By 1966, for example, tax men will be able to punch a button and find out if anyone in the land failed to file a return, cheated on deductions, owes for previous years, or phonied the whole thing. Till now, communication between various tax districts has been nearly absent. With the new system it will be easy to put the finger on such people as the ex-lawyer who made out 56 returns for himself, all of them claiming refunds, in 16 cities.

How does the whole thing work? Well, let's follow the return of hypothetical Oscar Farley of Mobile, a lathe operator. Old Oscar doesn't do anything different this year—just files his papers barely before the deadline as always. In this case, the forms go to Oscar's local District Director in Birmingham.

[Continued on page 206]

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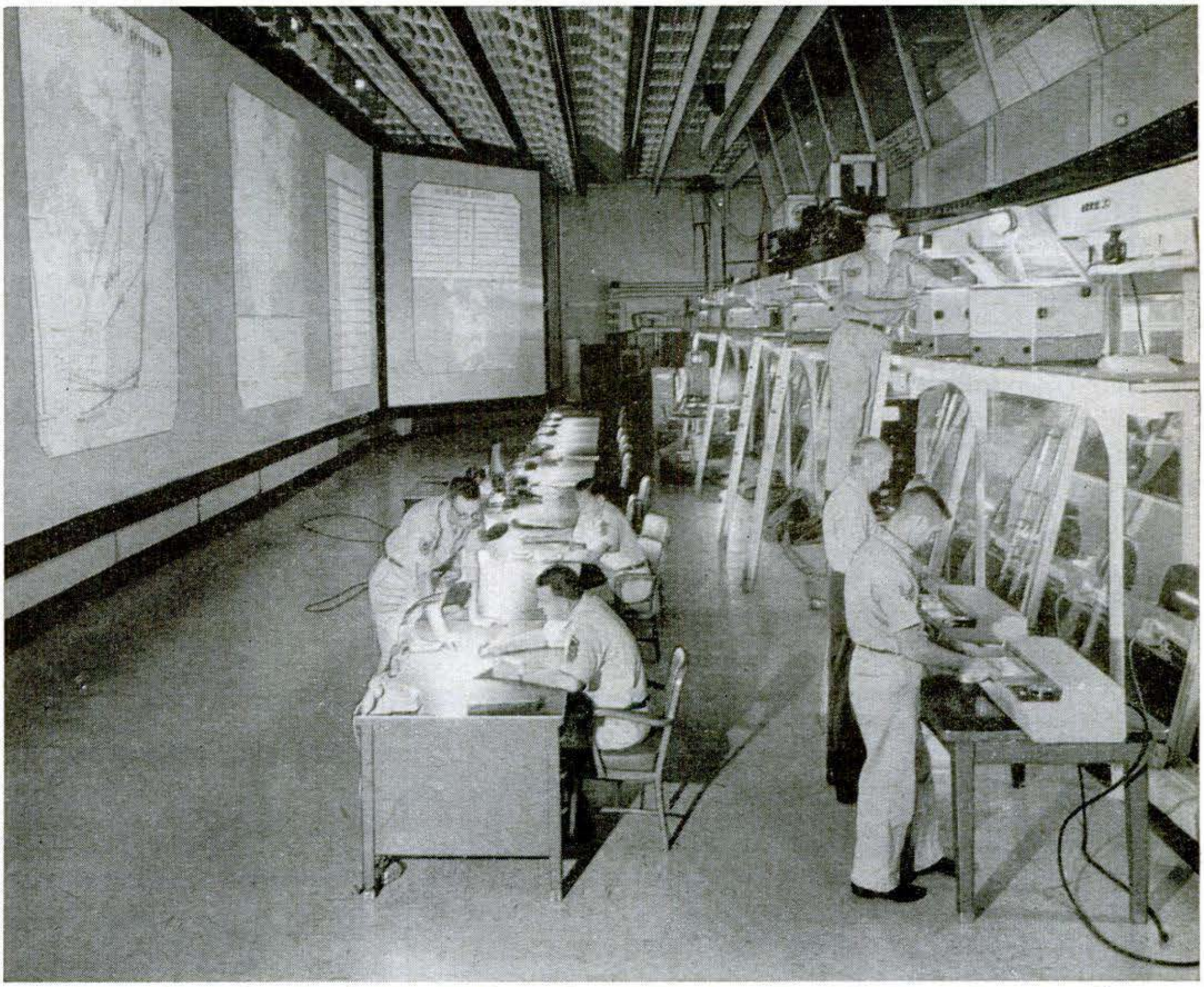

Four of six charts that can be projected simultaneously are shown here on 17-by-96-foot screen lining one side of SAC war room. Transparencies are made on copying machines at lower right for six projectors above them. Battle staff views data from balcony at upper right.

Map projections speed SAC war-room display

Less than 30 seconds elapses between receipt of information and the time it is flashed on a vast screen where it can be studied by the battle staff in the Strategic Air Command's war room near Omaha, Nebr. The new system in the underground three-story, reinforced-concrete command post at Offutt Air Force Base works this way: The printed sheet with critical data on it is passed through a copying machine that transfers the data onto a plastic transparency. One of six projectors then projects this through an overlay map. The transparency film was developed by Minnesota Mining and Manufacturing Co.

Transparency projection replaces a system that required wheeling out of up to 40 8-by-20-foot plastic panels mounted on trolleys. Data had to be transcribed by hand. The same number of maps and charts on 10-by-10-inch overlays can now be kept in a file folder.

The old way involved bulky panels that had to be trundled around. Technicians on electric-powered hydraulic lifts posted data on panels by hand from vocal directions.

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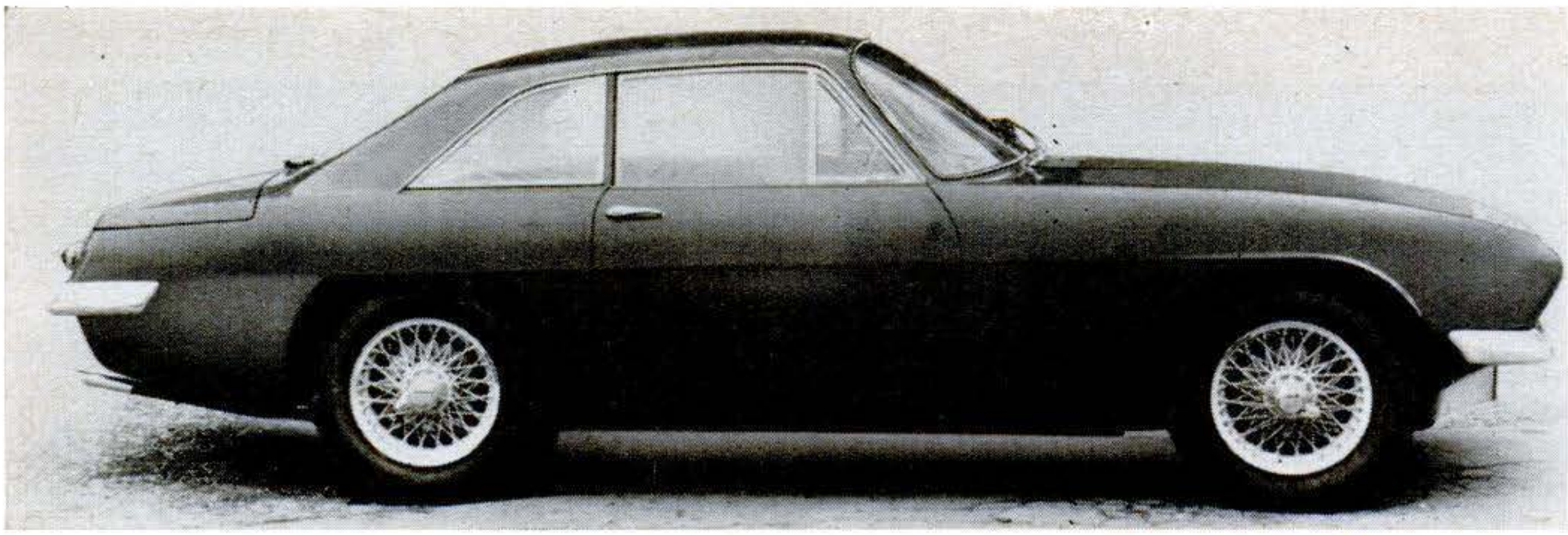

Daimler with a fiber-glass body

Limousine comfort and high-speed motoring are combined in the Ogle SX.250. The occasional-four-seater body of fiber-glass is based on the Daimler SP.250 chassis and 152.5-inch, 140-hp. V-8. A four-speed manual or an automatic transmission is offered. All four wheels have disk brakes. It costs over $6,000 in England.

New and Hot from Overseas

British Jensen uses American engine

The Jensen C-V8 is a genuine four-seater built exclusively for the U.S. Its 361-inch, 305-hp. Chrysler engine gives acceleration from 0 to 60 in 7.8 seconds and a top speed of 140 m.p.h. TorqueFlite automatic transmission or manual shift with overdrive is available. The body is fiberglass. All brakes are disk. Price is $9,800 in England.

Sports-utility wagon by Ghia

This practical sportster from Italy is built by Ghia over a Fiat 2300S coupe chassis. The five-seater combines sports-car performance with station-wagon luggage room. Swept tailgate can be secured in horizontal position. Rear seat folds forward. Twin-carburetored 139-inch engine puts out 150 hp. for 115-m.p.h. top speed.

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Tiny Mistral packs big punch

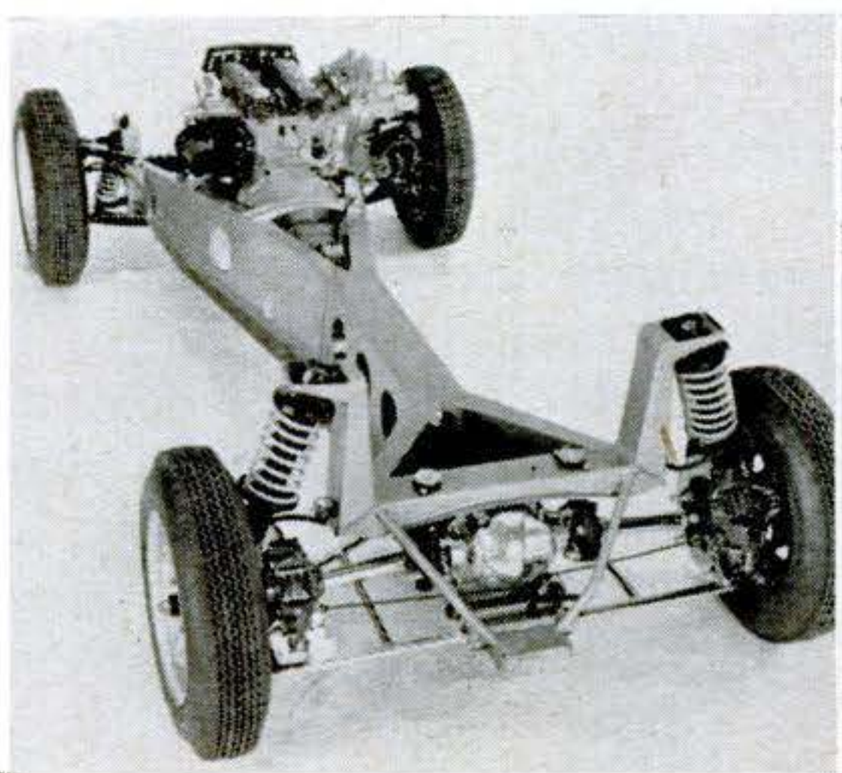
The Mistral 1500 TS coupe, built in Germany by NSU-Neckar, is based on Fiat parts. Its 90-inch engine is beefed up with an aluminum head and twin-choke carb to deliver 94 hp. at 6,200 r.p.m. Acceleration to 100 m.p.h. is said to be brisk, and there are disk brakes on the front wheels to slow it down. The 14-foot body is Italian-styled.

Bentley sports convertible

The world's costliest production sports car (tagged in England at $25,000) is the Bentley S3 Continental with convertible body by Park Ward. The Rolls-Royce chassis houses an aluminum V-8 mated to a four-speed automatic gearbox. Body is of steel and aluminum. Quad headlights give more light than duals on earlier Bentleys. Power-operated top is standard.

First Israeli sports car

The unusually styled Sabra two-seater is assembled in Haifa, Israel, from parts shipped from England by Reliant Engineering. It is built on a box-section chassis with a reinforced fiber-glass body. A 90-hp. Ford Consul engine gives a claimed top speed of 110 m.p.h. Disk brakes are standard on front wheels. East Coast P.O.E. price is $2,995.



Lotus with English Ford parts

The Consul Classic-based Lotus Elan can be bought either assembled or in kit form. A Classic 91.5-inch engine with dual-overhead-camshaft head and four carburetors gives the 1,290-pound British flyweight a 100-hp. wallop. Chassis is of central backbone type. Headlights retract. The foam-filled resilient-plastic bumpers resist denting.

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REPORT FROM THE DRIVER'S SEAT

1,500 Miles in a Valiant

By Alex Markovich

With crisp cornering, pep aplenty, and speed to spare, the baby Plymouth for 1963 is a happy mating of fun and thrift

Tests with a fifth wheel showed the small-engine Valiant to be almost as fast as the 225-inch job in 40-60-m.p.h. range. The 0-60 times are slower because of hesitation just after takeoff.

Positioning of the steering wheel is fine. Bucket-type seats were comfortable, but didn't give my bottom much lateral support. Upholstery, though not lavish, is neat and functional.

IT MAY be the same friendly Valiant under the skin, but it looks completely different this year. The styling is clean, well-proportioned, perhaps a little bland, but generally attractive.

My pleasant acquaintance with the baby of the Plymouth line was renewed recently when I drove a Signet 200 from New York to Detroit and back. It was loaded: TorqueFlite, power steering and brakes, big 225-cube engine. Conclusion: The Valiant is one of the best combinations of practicality and fun made in Detroit today.

The appeal of the Valiant is not on performance alone. Acceleration and top speed are more than adequate, but one or two compacts are hotter. And the ride isn't the softest. In fact, it's firm by Detroit standards. But the car does one thing many of the others don't: It handles. At its top speed of around 100 m.p.h., it's as steady as Ben Casey's hand. Toss it around a tight corner and there's very little lean, no nasty unexpected tricks.

At high speed on smooth turnpikes, the ride is comfortable. Your posterior can't tell the difference from one of those softly sprung noodles Brand X

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Lots of head room in back. Hip room is adequate for three. Leg room? If you're over five-eight, try to get a front seat.

I liked that firm Valiant suspension even on rutted country trails like this. A soft, marshmallow ride makes me seasick.

puts out. On wavy, undulating roads, the firm springing actually gives a better ride. There's far less pitching and bottoming. It's the minor surface irregularities that cause trouble. Tar strips in particular are easily felt.

The most serious of my grumbles concerns the brakes. They fade much too quickly. And with power assist, they're unnecessarily sensitive, making it hard to stop smoothly in a short distance.

Instrumentation is well laid out and legible, but—as on most U.S. cars—I missed an oil-pressure gauge. And that partial horn ring on the deluxe steering wheel is a disconcerting example of what happens when the stylists get the upper hand. The plain-Jane wheel with the center horn button has one big advantage: The horn is always in the same place.

On the brighter side, the TorqueFlite automatic transmission is a dilly. It gives fast, positive shifts. What's more, it can be controlled manually, through the buttons, if desired.

The heater turns on like the breath of Hades. The optional two-speed wipers are more than worth their modest price. The radio has excellent tone and range.

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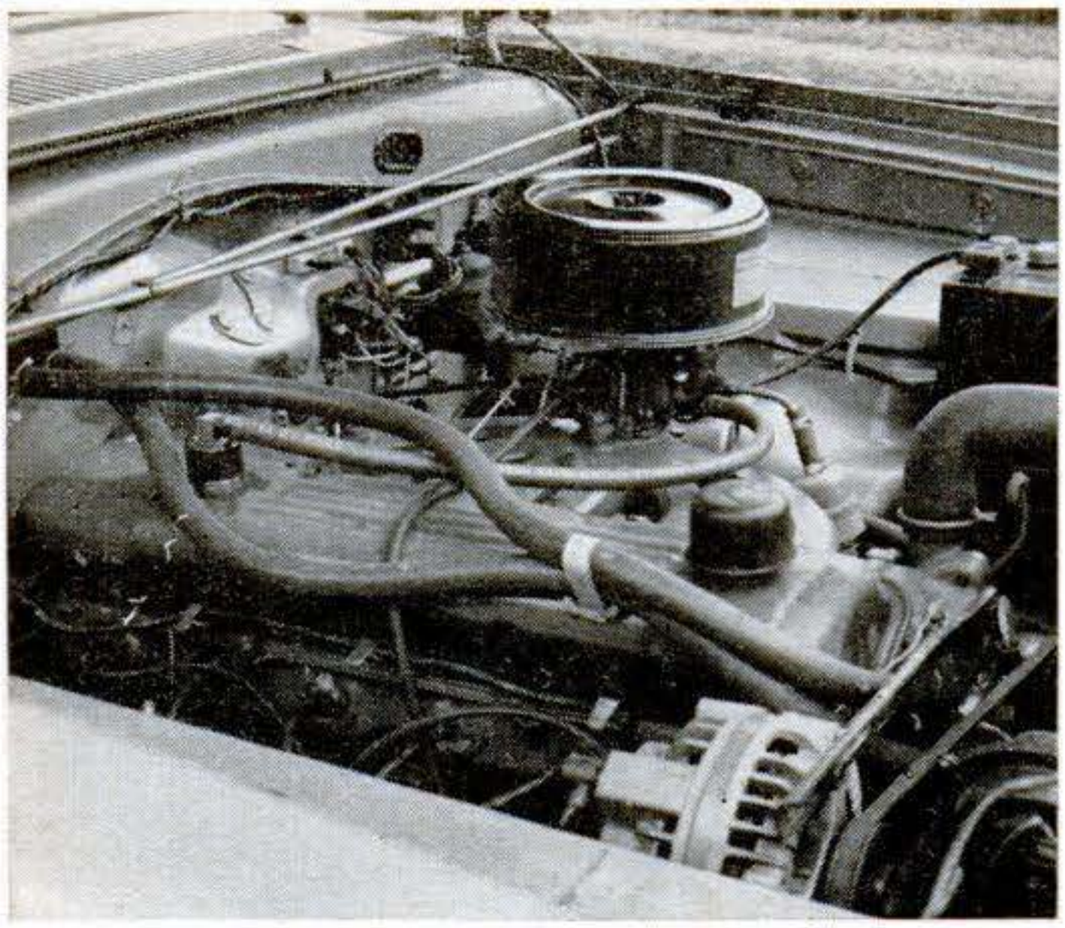

The in-line slant six offers easy access. I suffered no busted knuckles when reaching for the plugs and distributor.

Doors are big, and they open wide. Lack of dogleg in windshield also makes getting in and out easy, though car is low-slung.

When I got to Detroit, the Plymouth people let me try a stripped Valiant—with manual transmission, steering, and brakes, a bench seat, small 170-cube engine, and bread-and-butter trim. Surprisingly, this car proved to be as much fun as its loaded counterpart.

What the small engine lacks in torque, it almost makes up in rev-ability. It winds to 6,000 r.p.m. without threatening to burst at the seams. Acceleration is adequate. Using first and second gears, I ran 0-60 in 15 seconds flat; with second gear only, 40-60 took seven. The 50-70 run, using second and third, took 12.3 seconds.

A quick check of gas consumption indicated that the smaller engine with stick shift should give about four more m.p.g. at highway speeds.

The only thing I really missed on the stripped job is power steering. The faster ratio (3.5 instead of 5.3 turns lock-to-lock) is worth the very slight loss of road feel.

The choice between manual or automatic transmission is a toughie. I've always preferred a stick shift, but this one is about as exciting as the next-door neighbor's recent operation. It's synchronized well enough for Aunt Millie, but it resists speed shifts as a cat resists a bath.

All told, the Valiant is still a happy compromise between performance and economy, roadability and comfort. ■ ■

FACTS ON THE 1963 VALIANT

Model: Signet 200 hardtop.
Engine: overhead-valve in-line six; 145 hp. at 4,000 r.p.m.; torque, 215 pounds-feet at 2,400 r.p.m.; compression ratio, 8.2:1; bore and stroke, 3.400 by 4.125 in.; displacement, 225 cu. in.
Curb weight: 2,559 pounds.
Transmission: TorqueFlite (3-speed automatic).
Steering: 3½ turns lock-to-lock (power).
Effective brake-lining area: 153.5 sq. in.
Outside dimensions: wheelbase, 106.0 in.; overall length, 186.2 in.
Tire size: 6.50 by 13.

Speedometer error:

Indicated m.p.h.	*Actual m.p.h.*
30	31
40	40
50	50
60	59

Gas mileage at constant speeds:

30 m.p.h.	25.45
40 m.p.h.	23.90
50 m.p.h.	22.41
60 m.p.h.	20.64

Gas mileage in stop-and-go driving: 17.5.

Acceleration:

0-60 m.p.h.	11.9 seconds
40-60 m.p.h.	5.9 seconds
50-70 m.p.h.	8.1 seconds

Top speed: 103 m.p.h. (estimated).

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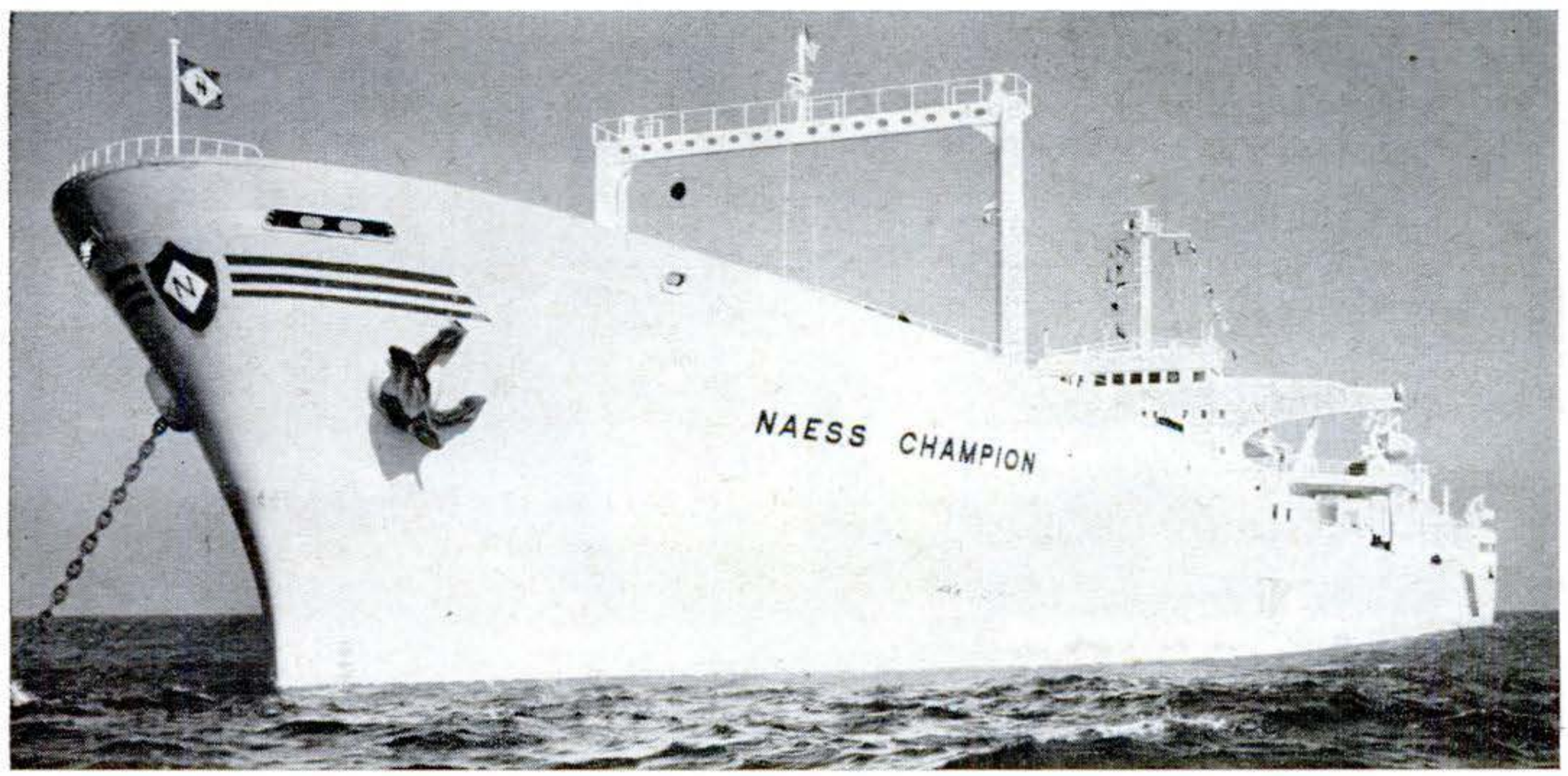
Hybrid helicopter has wings and prop, besides rotor

A ring-tail pusher propeller and stub wings on the new Piasecki 16H above increase its speed to 170 m.p.h. and payload range to 600 miles. The ducted prop in the tail provides propulsion in flight and counter-torque for takeoff and hovering with the main rotor spinning. Wings and rotor are hinged for parking in small space.



Big tanker carries a lot of oil

One of the world's largest oil tankers, the 88,500-ton Naess Champion anchors above at Los Angeles with 644,000 barrels of crude oil from the Persian Gulf. The ship is 875 feet long, has a draft of 47½ feet and a beam of 122 feet. Built in Japan, it flies the British flag, is manned by British officers and a crew from India.

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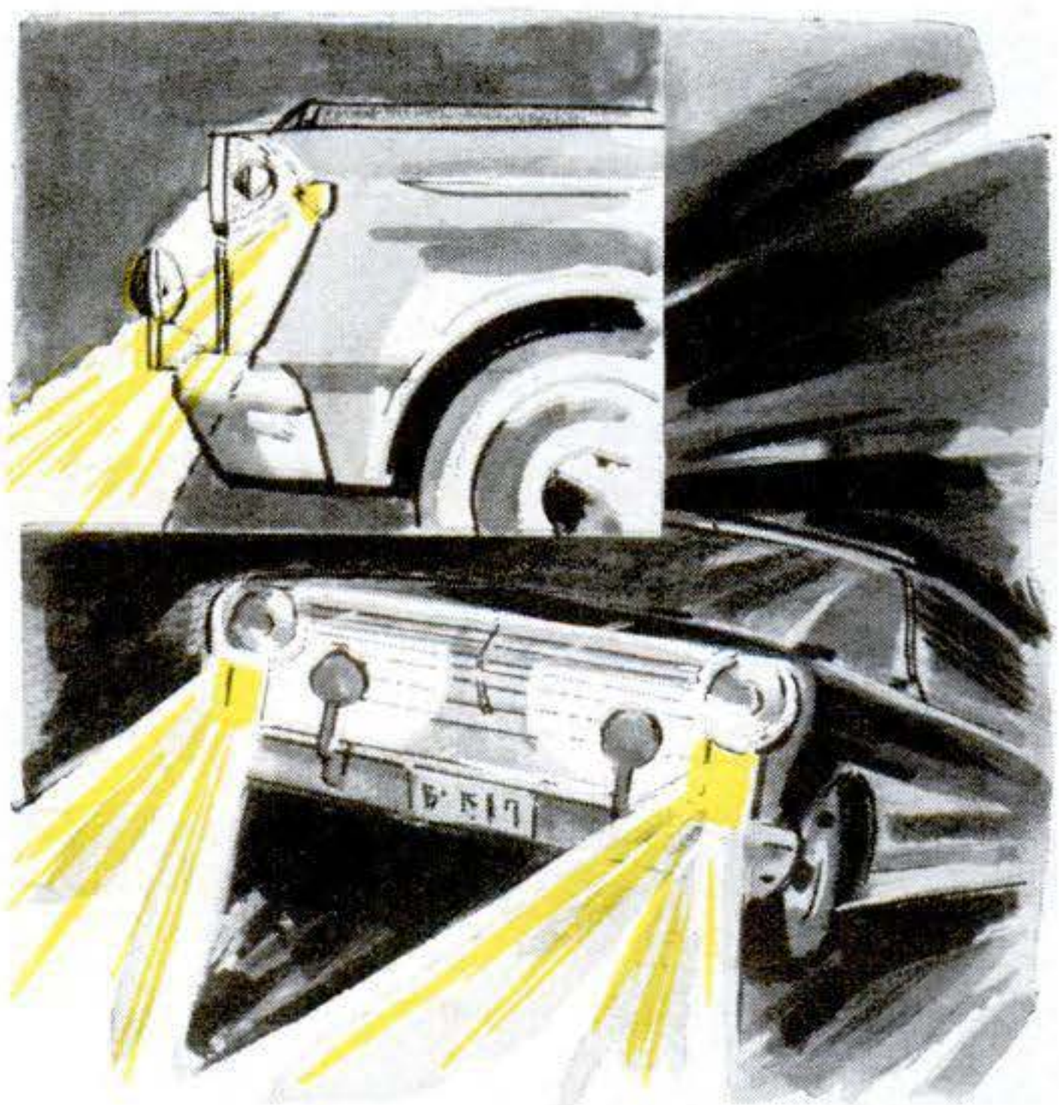
New ideas from the inventors

Buoy docks ring of boats. Bumpered arms radiating from the central, anchored buoy of this recently patented mooring would provide slips for many boats in the space normally needed for one boat to circle its buoy. Perforated and buoyant aprons, suspended from the arms, would keep the tied-up boats snug but separate even in turbulent waters.

Ashtray fits cigarette box. You wouldn't have to hunt for an ashtray (or interrupt a conversation to use one across the room) if you slipped one of these molded-plastic boxes over the bottom of your cigarette pack. The accessory would have a side-opening drawer that could be pulled out, when needed, to receive ashes.



Shaded lights cut glare. Separate headlights, aimed downward, might eliminate glare in passing. Stepping on the dimmer switch would (1) flick off high beams; (2) turn on auxiliary headlights that would shine down through fender slots; (3) turn on bumper lights, aimed back at the grille to make your car more visible.

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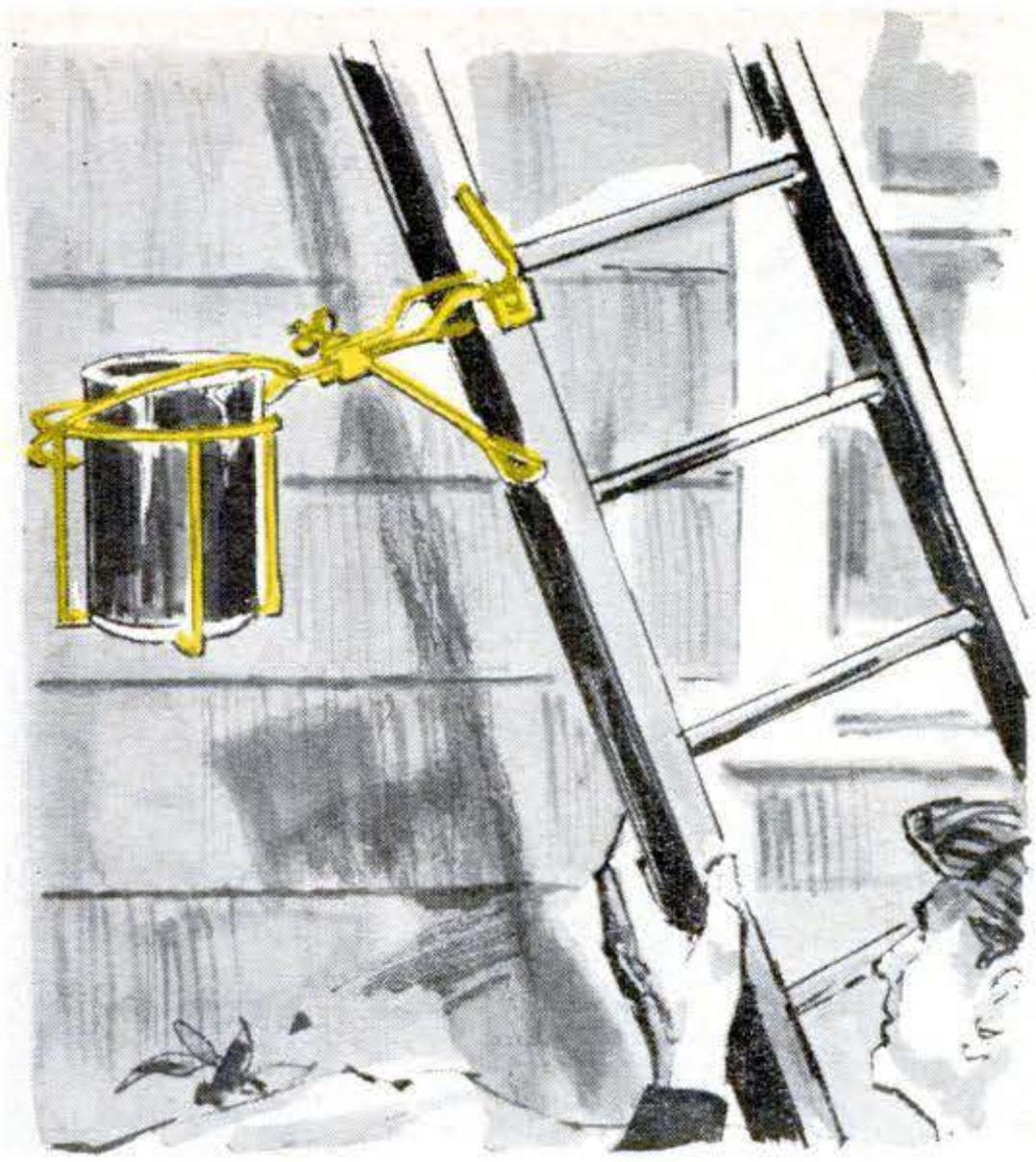
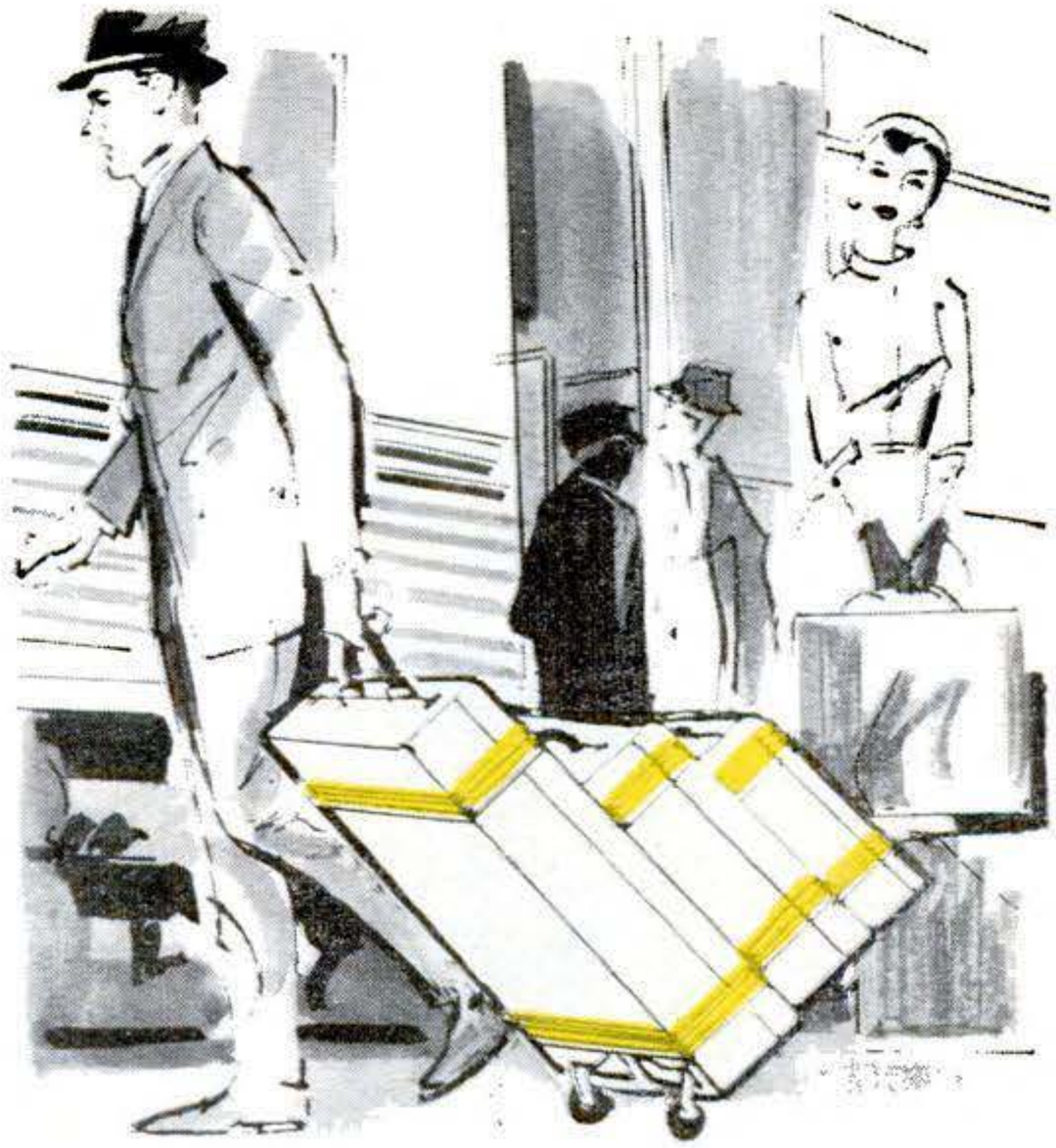
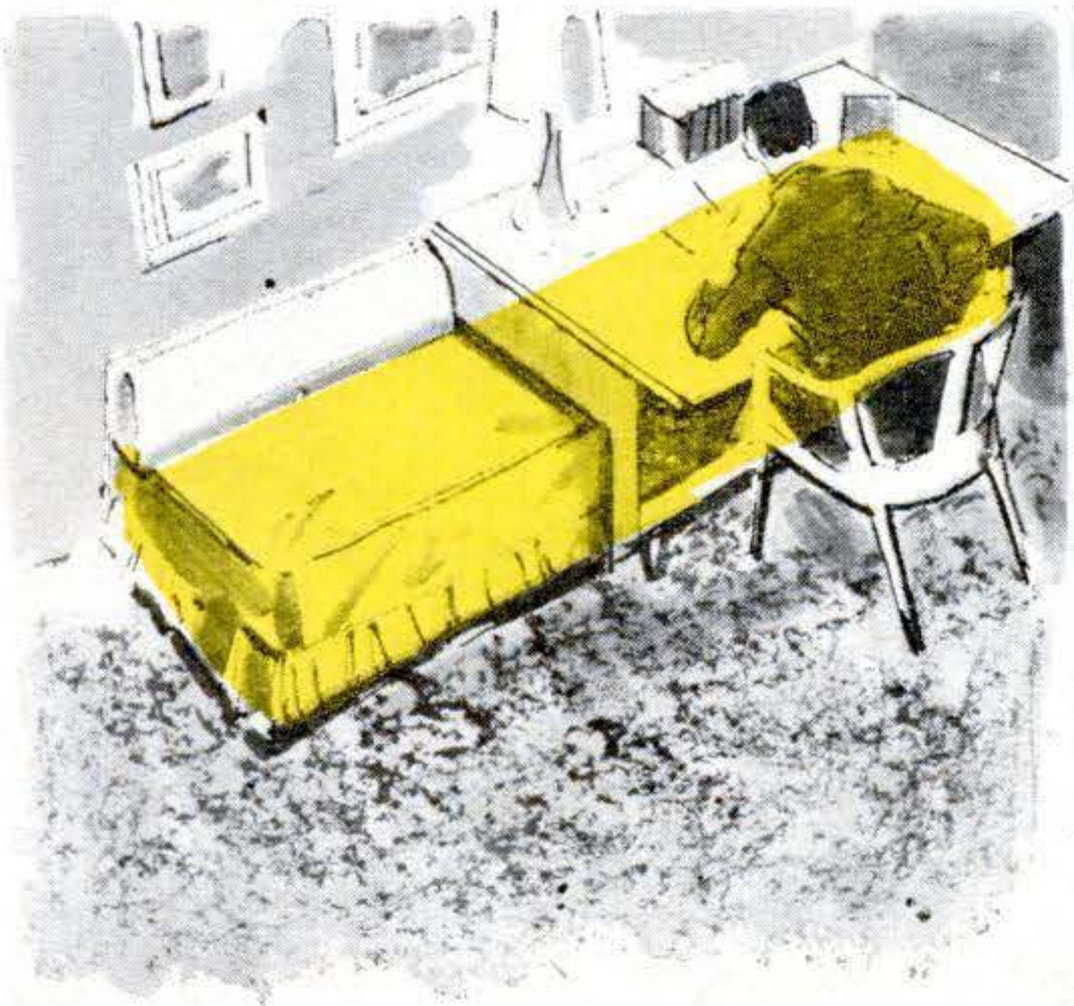
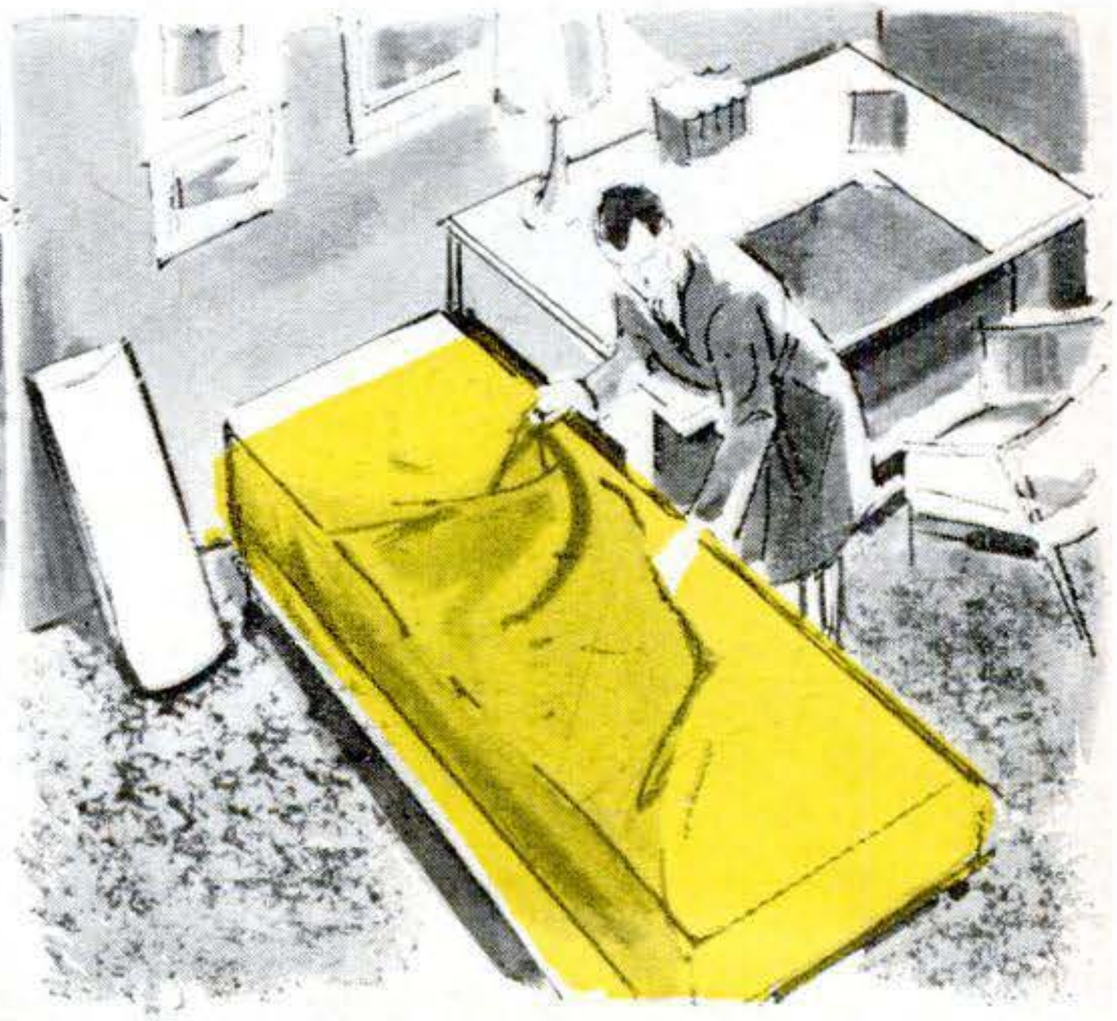


Ladder clamp levels bucket. You could move a ladder on a job without worrying about upsetting a clamped-on paint bucket if it were held by this self-leveling clamp. An adjustable arm would brace the bucket holder against the ladder, and a pivoted wire cradle would keep the pail upright regardless of the angle of the ladder.



Luggage wheels fold out. These retractable wheels, normally pocketed inside a large suitcase, could be pulled out, when needed, to let you move your luggage more easily. Interlocking ridges near the end would keep matched cases from sliding, and would let you use the largest unit as a carrier for the stacked set of cases.





Desk hides extra bed. Your den could double as a guest room if you furnished it with this combination desk and couch. Pushed under the desk through a cut-out side, the couch would project enough to serve as a chair. For use as a bed, it could be pulled out and swung around, with the head of the couch back against the wall.

The following patents have been issued on these inventions: **Buoy dock**—*No. 3,041,639 to G. Atlas, Chicago;* **Ashtray**—*No. 3,057,465 to F. Quercio Jr., Worcester, Mass.;* **Shaded lights**—*No. 3,054,888 to I. Yamashita, Yokosuka, Japan;* **Bucket clamp**—*No. 3,051,428 to A. Schult, Laurelton, N.J.;* **Luggage wheels**—*No. 3,057,636 to A. D'Ettorre, A. Heck, and W. Kauffman, W. and D. Ranville, Fairborn, Ohio;* **Bed-desk**—*No. 3,041,633 to D. Bendell, Miami, Fla.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

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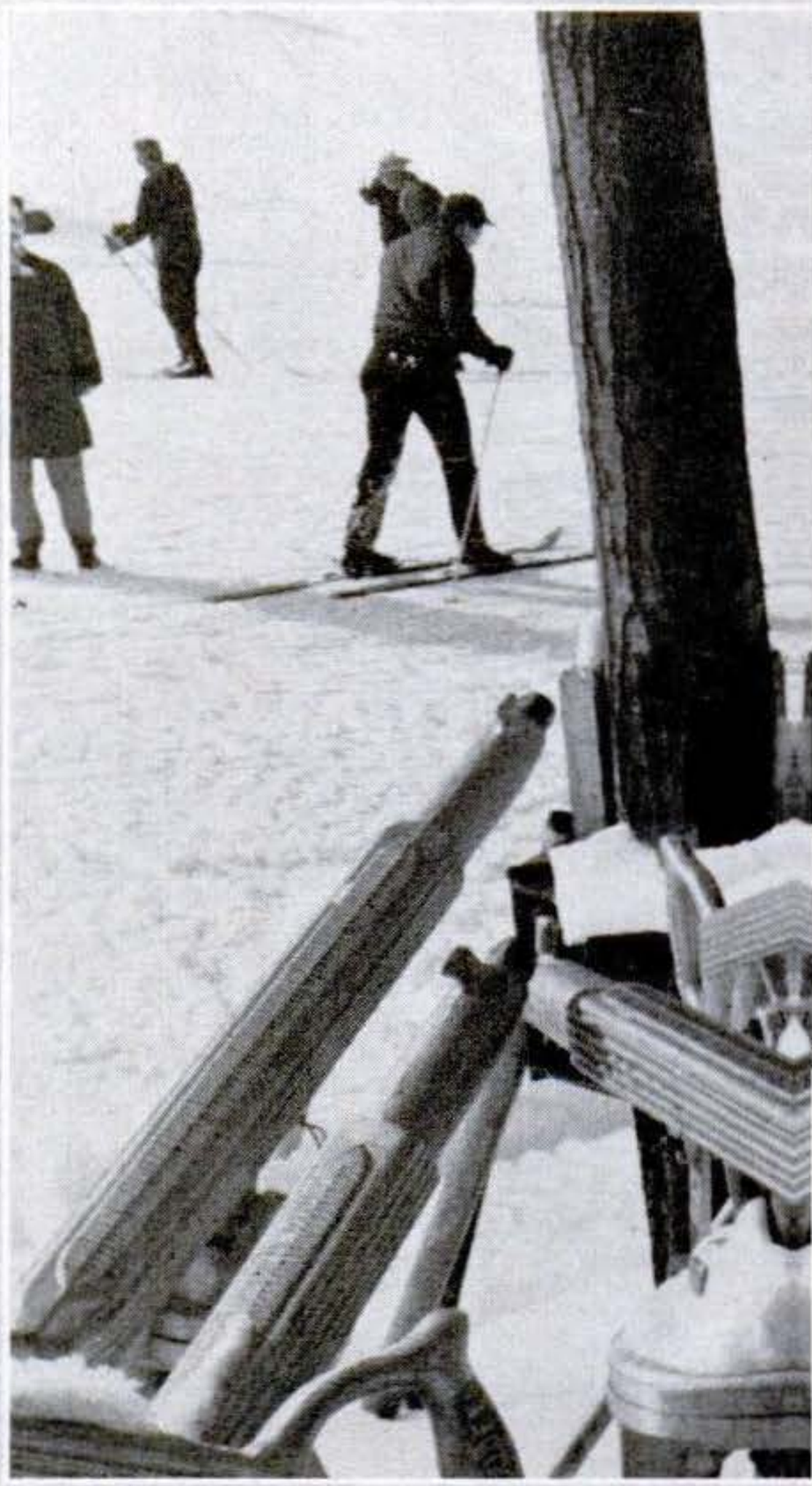
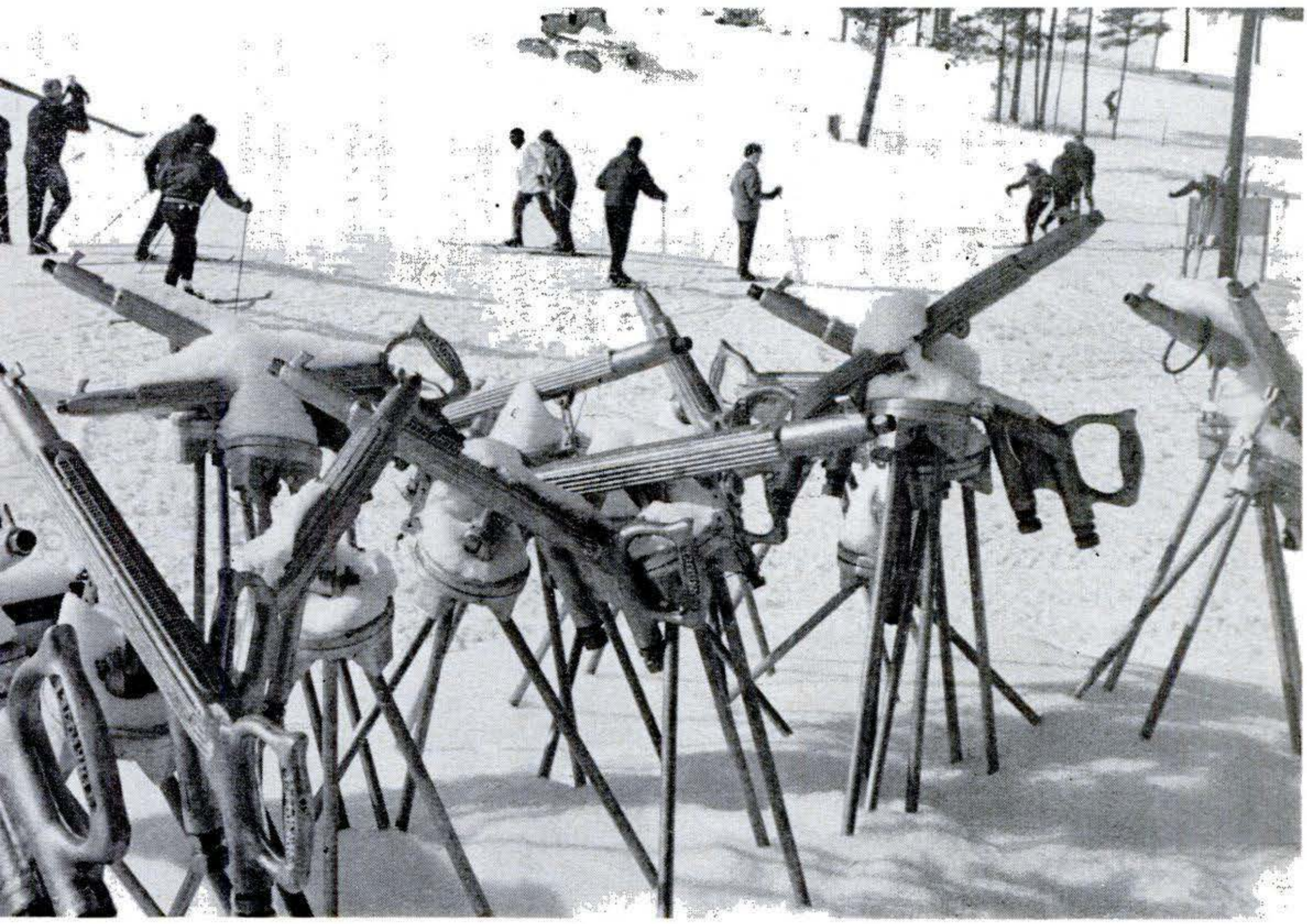
Snow at the Turn of



Snow gunner grips weapon to fight bare spots—enemy of skiers—by laying down barrage of white. Only natural snow (seen on idle guns, right) brings day of rest.

a Switch

Now you can ski earlier, later, and farther south, as mechanical blizzards beat nature in making perfect slopes



By Jackson Hand

THREE years ago, on the eve of the big midwinter vacation period, a thousand or so skiers watched a typical northern Wisconsin snowfall blanket the slopes of Mt. Telemark. The next day dawned clear and an ideal 20 degrees. With four inches of new powder sparkling under their runners, they were all as happy as a skier getting his first view of the Alps. So was Tony Wise, who had developed Mt. Telemark into a wintertime playland.

As the day wore on, the temperature rose slowly. About two o'clock, a misty drizzle set in—followed by plain, common, ordinary, outrageous rain—in northern Wisconsin—in December!

At Mt. Telemark, near the village of Cable, there was not another day of skiing all winter. News picture services sent out photos of imported ski instructors picnicking on the grass—very funny. But it was no joke to the skiers of the Midwest and Northeast, for nearly every ski area was similarly struck down by weather that was too warm—by snow

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that came down as rain. Winter vacationers headed for cruise ships.

Early in the spring, Tony Wise turned to Joe Tropeano of Lexington, Mass., for help. Joe's company, Larchmont Engineering, makes the "Snow Gun." Tony contracted for a dozen or so guns, seven *miles* of pipe, and a couple of weeks of Joe's consulting services on the grassy slopes of Mt. Telemark. All summer long, pipe fitters, well diggers, back-hoe jockeys, and carpenters toiled uphill and down. Toward fall, trucks arrived with five huge air compressors, high-volume water pumps, a generator, diesel engines. On November 16, everything was ready.

AND it snowed. For 100 hours snow fell on Telemark. Man-made snow. The rest of northern Wisconsin was the color of dry, brown grass and crimson autumn leaves. But Mt. Telemark was as white as Santa's beard.

All winter long, whenever nature failed to provide the required snowfall, Tony Wise threw a big switch, the machinery started to throb and whine, and the white stuff drifted down.

For the thousands of skiers who live within station-wagon distance of Mt. Telemark, Joe Tropeano's snow machines on Tony Wise's hill mean two recreationally essential things:

- There will be snow a month earlier and a month later, every winter.
- There will be snow—skiing snow—every day and every weekend, so when you plan a junket, you can be sure you'll be able to ski.

The snow machines bring the same glee all across the continent to three million more (skiing is the fastest-growing outdoor sport in the world) because they "make snow" at roughly 60 ski areas. As far north as Mt. Gabriel in Quebec, as far south as Mexico City, as far west as Lake Arrowhead, Calif., and at such sidelight areas as the U.S. Military Academy at West Point, people are slaloming on man-made snow.

AND they call it better than the regular stuff! Why? Because an operator who knows his Snow Gun can turn out just the kind of snow that is best for the situation.

At Mt. Ascutney in lower Vermont, a winter ago, alternate freezing and thawing, along with some rain, had turned practically every slope into a steeply angled hockey rink. You couldn't control your skis. Skiers who tried were getting hurt. Many areas closed down completely. Those with snow machines did as Ascutney did.

Starting at the bottom (it was too slippery to start anywhere else), workmen spewed a wet snow on the glare ice to form a sort of honeycomb bond on the surface. Gradually they dried out the snow—easy with a snow machine—until they ended up with the liveliest sort of "corn" snow. It stayed put. It didn't blow off. Walking on this firm footing, the crews worked up the hills. Slope by slope, Mt. Ascutney was restored to Alpine perfection.

The principle of snow making was discovered by accident. Joe Tropeano's brother, Phil, was experimenting one day with cloud-forming equipment to protect citrus fruit from freezing (agriculture and irrigation are Larchmont Engineering's main business). Called to the phone, he left the nozzle running out in the factory yard. When he went back to the spray machine he found a nice fall of snow on the ground.

"Hey, come look!" he called to Joe.

One look at the pile of snow on the ground told Joe (an enthusiastic skier) that there lay the solution to nature's indifference to man's delight in sliding downhill.

Working together, the brothers (they're both hydraulic engineers from the University of Massachusetts) licked early problems. First, the snow was too much like hail. It shot out like pellets from a shotgun at full choke, and didn't spread out to cover enough ground. Moreover, it wouldn't pack into the sort of snow

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produces, say expert skiers

a skier will travel hundreds of miles to find.

THE key to the matter was air. You couldn't merely spray the water, no matter how much pressure you put back of it. You had to *blow* it out.

When Joe and Phil finally finished with experimentation, they had "invented" the atomizer—much like the squeeze-bulb perfume sprayer that has adorned women's dressing tables since the 1800s. It was hardly a patentable idea, however, although their company does hold a "methods patent" for the trick of combining water and air under pressure in freezing temperatures to produce snow.

Early models of the snow machine confessed to their agricultural-equipment ancestry by looking like lawn sprinklers. As the device was smoothed out a little, the Tropeanos decided that rifling inside a delivery tube would set up a spiraling action and carry the atomized and frozen water farther. At the same time they began calling it the "Snow Gun."

"When we asked one of the men in the foundry to design a mold for casting it in aluminum," Joe explains, "he got carried away a little." The result looks like a machine gun. All that is really required is a tube with a restricted nozzle at one end, a hose connection for the air at the other end, and a tee to which the water hose can be connected. You could put it together at a plumbing shop. In addition to the rifling, angled ports smooth out the flow of air and water just as well-designed headers ease the flow of exhaust from an efficient engine.

What you see when you're skiing is a tripod-based gadget that looks like a machine gun abandoned by paratroopers. What you don't see is all the machinery and all the engineering.

THE setup starts at wells, a lake, or a reservoir with 125-hp. pumps that can lift 10 gallons of water a

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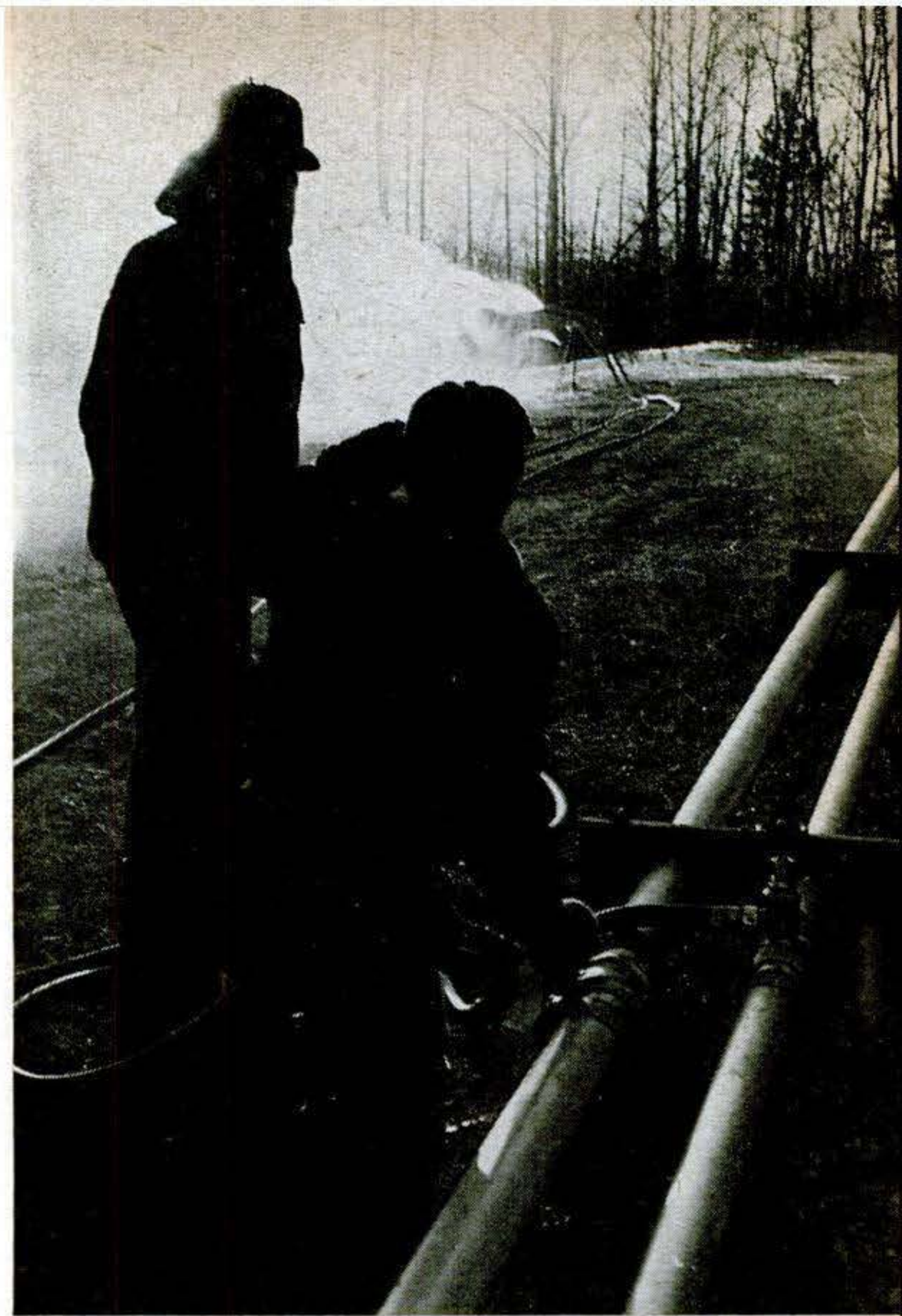

Bundle-up nights are best for making snow. At Mt. Telemark, they've coated slopes in a bleak 39 below. At 20 above, a machine can put three inches on 100 square feet in 15 minutes.

Plenty of snow on the hills—hardly any on the parking lot. Telemark lays down a hard, thaw-resistant base early in the season, and uses snow machines for daily grooming.

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PS PHOTOGRAPHY

Shooting with Available Light

By Arthur Rothstein

With ever faster films and lenses, anyone now can take good pictures under lighting situations considered impossible a few years ago. To help you in making better available-light shots, we asked Arthur Rothstein, one of America's outstanding photojournalists, to write about his experiences. Author of the book, *Photojournalism,* he also writes a column on color photography. He has won many awards. Some of his photos are in the permanent collections of the Museum of Modern Art, George Eastman House, Rochester, N. Y., and the Library of Congress. The photographs illustrating this article were taken for *Look* magazine, where Rothstein is Technical Director of Photography.—*The Editors.*

MANY of the most powerful and effective photographs that you see in newspapers and magazines these days are made with available light. This is a technique used more and more by professionals. If you haven't used it, you'll want to try to duplicate the exciting visual effects achieved by this lighting method.

"Available light" is sometimes called "existing light"—the conditions prevailing at the scene. It means you choose to leave the quality of the lighting unaltered and, instead, adapt your camera, lens, and film to the character and level of the illumination at the scene.

I find one obvious advantage in this method: My pictures have a natural, believable appearance. Also, since I'm not

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Paris rally was shot by available light with one-second exposure, camera on tripod.

concerned with the movement or precise placement of artificial light, I can work faster and more unobtrusively. This puts my subjects at ease and results in better pictures.

To use available light, you must be flexible—adapting quickly to various situations. I've learned that preconceived ideas must sometimes be discarded.

The use of available light goes back to the beginning of photography. The very first picture made by Daguerre in 1837, showing a corner of his studio, was a long time-exposure by light from a window. Brady photographed the Civil War by available light.

The introduction of the Leica camera in 1924, the first 35mm miniature, opened up a new world of available-light photogra-

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phy. Because of the unusual technical requirements of the 35mm camera, its adherents developed a new approach to photography. This was characterized by emphasis on waiting for the precise instant, or "decisive moment," stopping movement at its peak, selecting the most effective angle, and being able to see and compose simultaneously.

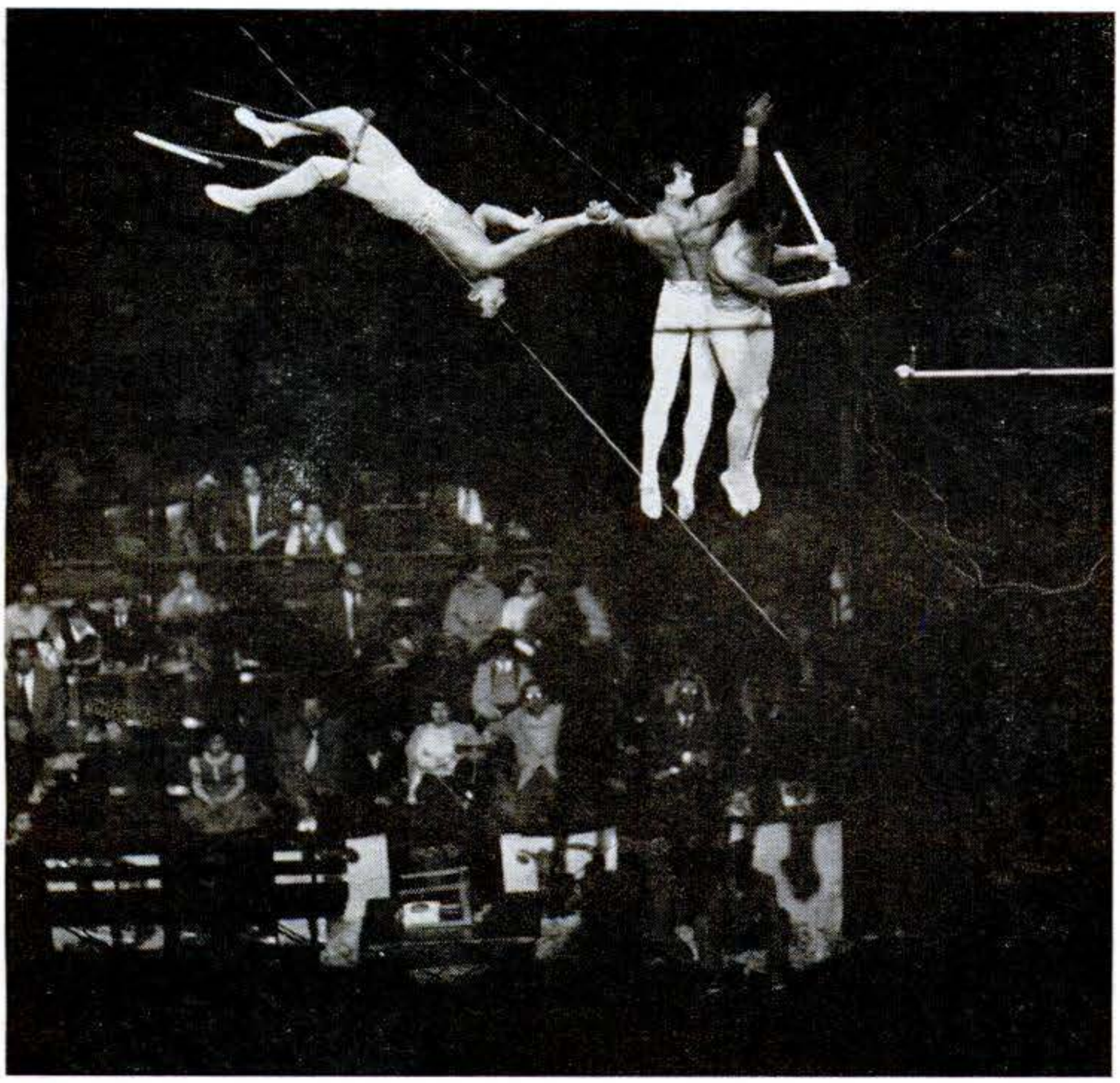
In 1935, when I worked for the US Resettlement Administration, later the Farm Security Administration, I used the Leica as one of my first cameras. I also used available light. However, I soon found that the techniques of available light could be applied to any camera. Walker Evans, another FSA photographer, used an 8-by-10 camera with available light. Dorothea Lange made many of her famous FSA photographs with a Rolleiflex and available light.

Although flashbulbs were available, we FSA photographers deliberately chose to work with existing light for three important reasons: First, the subject was not distracted or disturbed by the placement of lights. Second, the photographer was able to concentrate completely on the subject and the scene. Third, the photographs made under these conditions had a truthful, believable, and powerful effect.

A certain amount of skill is required to use available light properly. You must adjust exposure as the light changes. Viewpoint and angle must be carefully selected. You must be alert to take advantage of shifts in position and lighting. Backgrounds are important. Here is where selective focus and control of the depth-of-field can enhance a photograph. The background can become part of your photograph and add greatly to its effect. Or it may be eliminated altogether.

Much available-light photography is made at low levels of illumination. My experience indicates that a balance is required between fast films and fast lenses. At first, it might seem that the highest speed emulsions and lenses of greatest aperture would produce the best results. As an indication of this fallacy, the modern J-66 Polaroid camera uses a lens of normal aperture and a film with an exposure index of 3000 to produce photographs automatically under any existing light situation. As films become faster and increase in resolution, the importance of the fast lens diminishes. Practically any 35mm camera equipped with an f/3.5 lens or faster is satisfactory for available light photography.

I have been using a camera that seems



Circus aerialists under spotlights: 300mm tele; exposure of 1/500 second.

Close-up of Khrushchev at UN: 500mm telephoto lens on SLR.

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Crawford Greenewalt, Du Pont president: 1/125 exposure, 90mm lens.

Time exposure of old Colorado hotel—light is from window.

ideally suited for available-light photography. This is the Olympus Pen, which has a 28mm f/1.9 lens, an exposure meter, and produces 18-by-24mm negatives, or half the standard 35mm picture. It's small enough to carry in my pocket. The short focal length provides considerable depth of field at its widest aperture. I took it to lunch with a group of other photographers. They were soon passing it from one to another, clicking away in the dim light of the restaurant. At exposures of 1/30 at f/1.9, with Tri-X, the results were excellent.

In shooting available-light pictures, I have found one technique valuable. I keep exposures taken under different conditions separate.

If I have been busily shooting indoors, for example, and I move outdoors, I always start with a fresh roll of film, regardless of the number of exposures I have made. Sometimes, I use two cameras for this purpose. In this way, all the exposures on a roll of film will be made under the same light conditions. Thus, when the film is developed, adjustments can be made that will affect all negatives equally.

Available light is fine for portraits. Recently, when I was photographing Crawford Greenewalt, president of Du Pont, I had to make many exposures while he was being interviewed, without intruding in the conversation. Fortunately there were windows at his left and right that created an excellent side-light effect. Using a Leica M-3 with a 90mm f/2 lens and Plus-X film, I could keep at an unobtrusive distance and enlarge any portion of the negative with good resolution.

At a meeting of the UN General Assembly, I was assigned to photograph Khrushchev. Here, available light was all I was permitted to use. Also, I was about 200 feet from the speaker. I used a Nikon F single-lens reflex with a 500mm lens on a

[Continued on page 196]

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How to Get Started with a METAL LATHE

Working shiny metal fascinates every man who likes tools. A lathe is the tool of all tools

By John Burroughs

TO THE pro machinist the metal lathe is the one really indispensable machine tool. To the guy with a basement shop, it's the power tool to aspire to. There's just no other shop machine like it—the metal lathe is in a class by itself.

When you've learned to manipulate its levers and cranks, shift the gears and belt drive, grind bits and use attachments, you'll be able to handle more machining operations on your lathe than you could with a whole machine-shopful of other power tools.

It will work steel, brass, aluminum, plastic, and wood. It turns, grinds, bores, threads, mills, broaches, reams, and knurls. It's the toolmaker's tool.

Yet when you give a metal lathe a close look, you'll see that it's really a simple machine. It's essentially just a wood lathe

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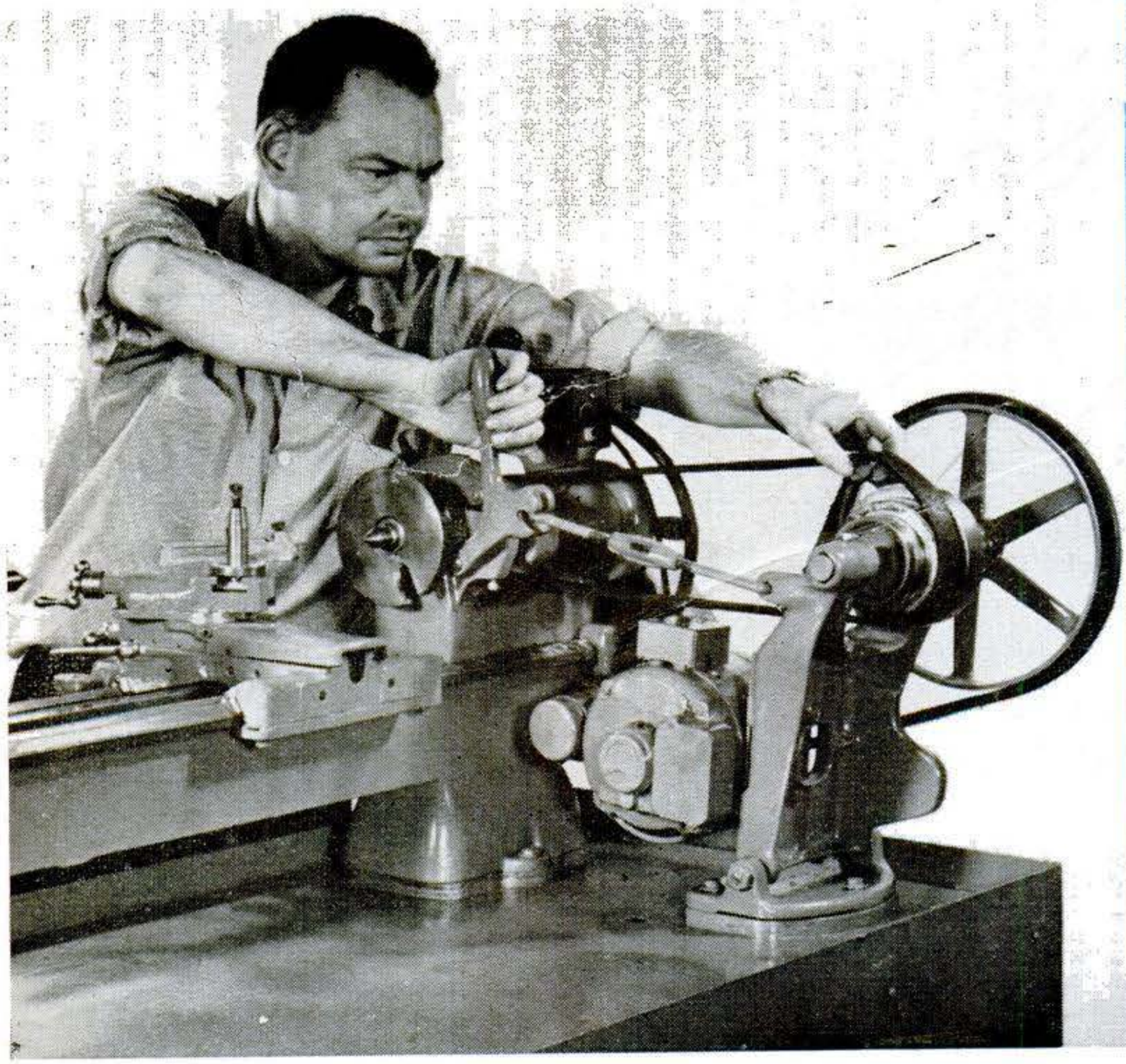

Most bench lathes use step-cone pulleys to get different speeds. Some have flat leather belts, some V belts. A toggle-type linkage relieves tension on belt for shifting from one pulley step to another to change speed (left). Direction of rotation is controlled by forward-reverse switch.

Lathe spindle drives the lead screw through a reversible gear train. Spindle may be locked to cone pulley to turn at pulley speed or be driven through back gears for large step-down in speed. Tool bit (lower right) is set at height of the center line.

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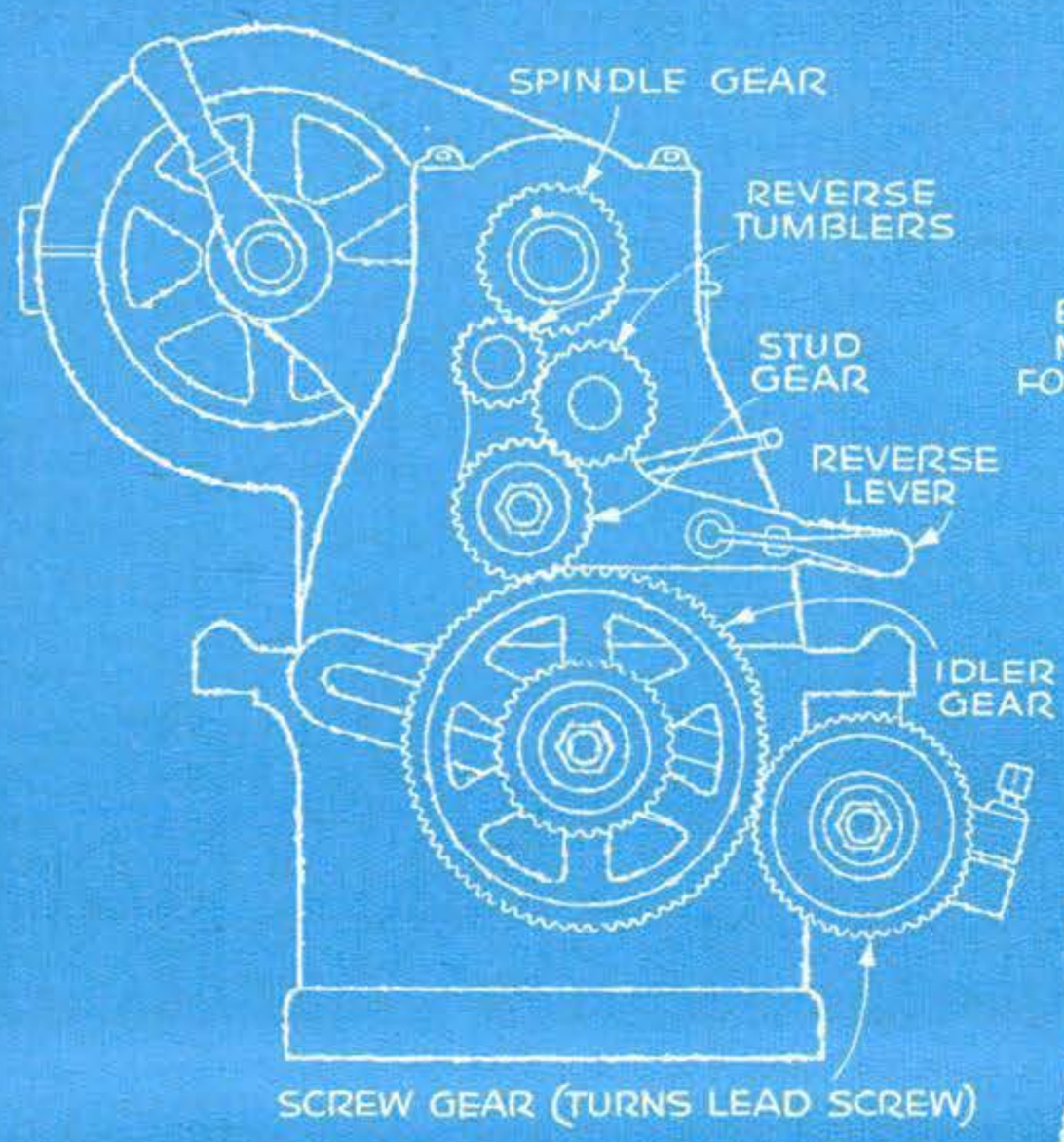
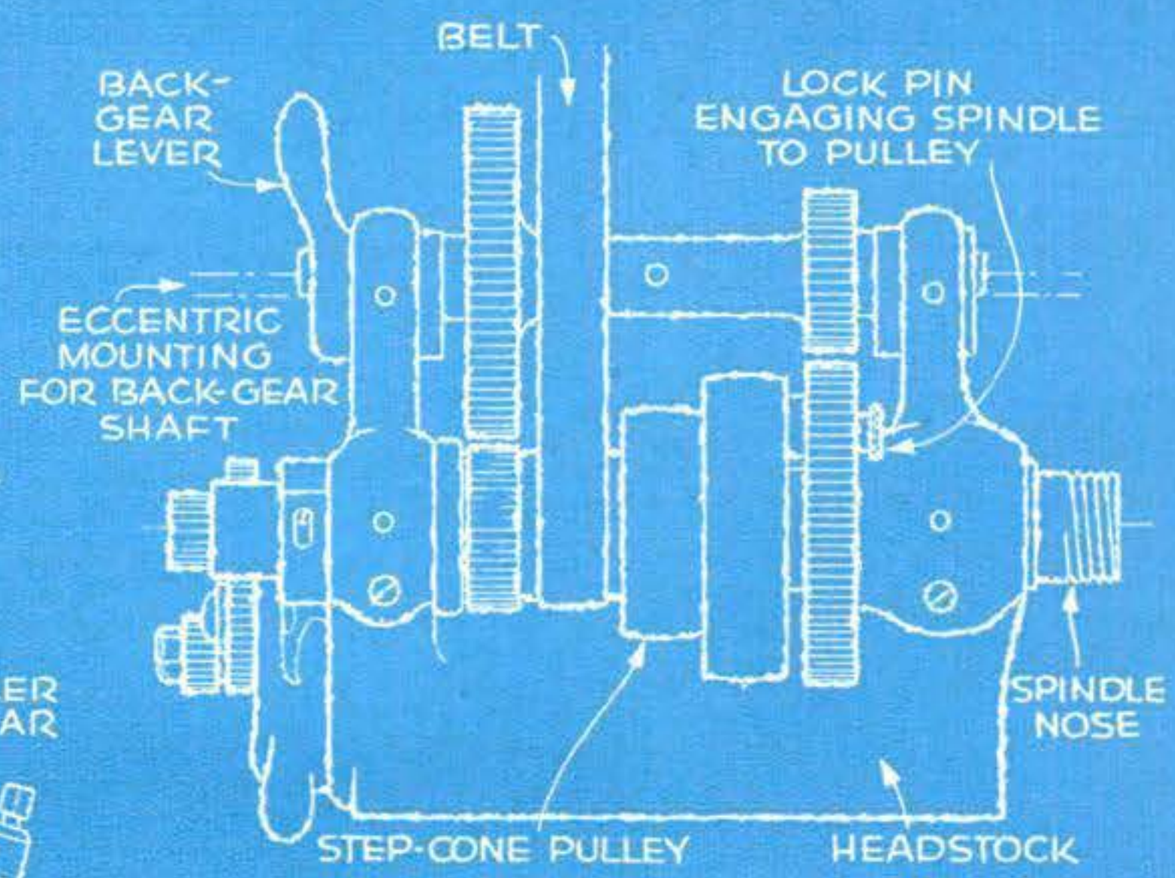
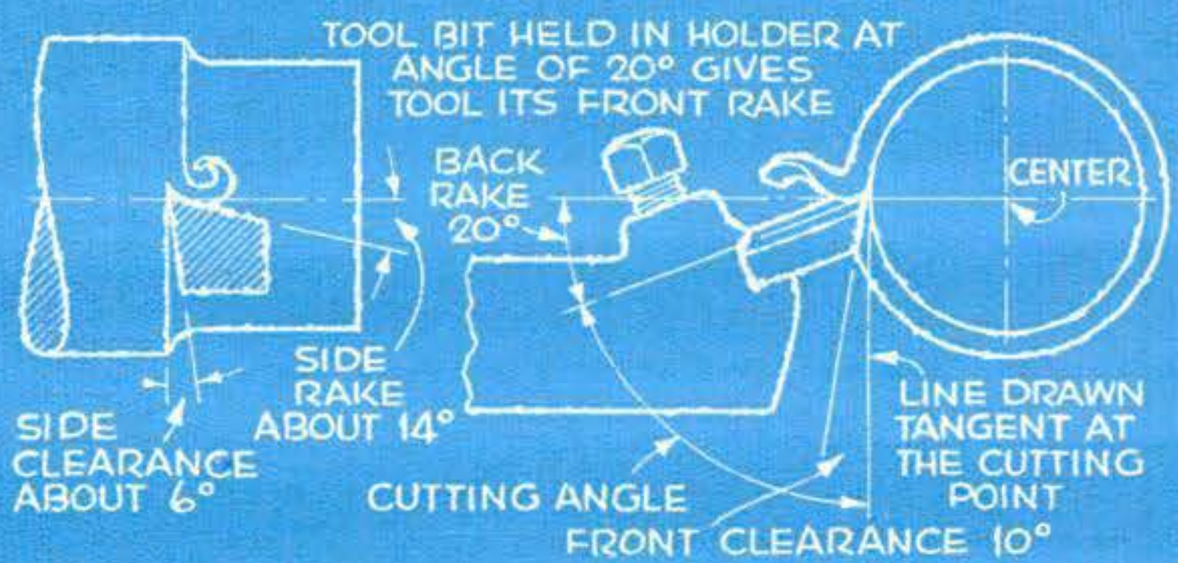
FORWARD-OFF-REVERSE SWITCH
LIVE CENTER
FACEPLATE
TOOL POST
DEAD CENTER
TAILSTOCK
COMPOUND REST
BED WAYS
CROSS SLIDE
CARRIAGE
LEAD SCREW
CROSSFEED
QUICK-CHANGE GEARBOX
LONGITUDINAL HAND FEED
HALF-NUT LEVER







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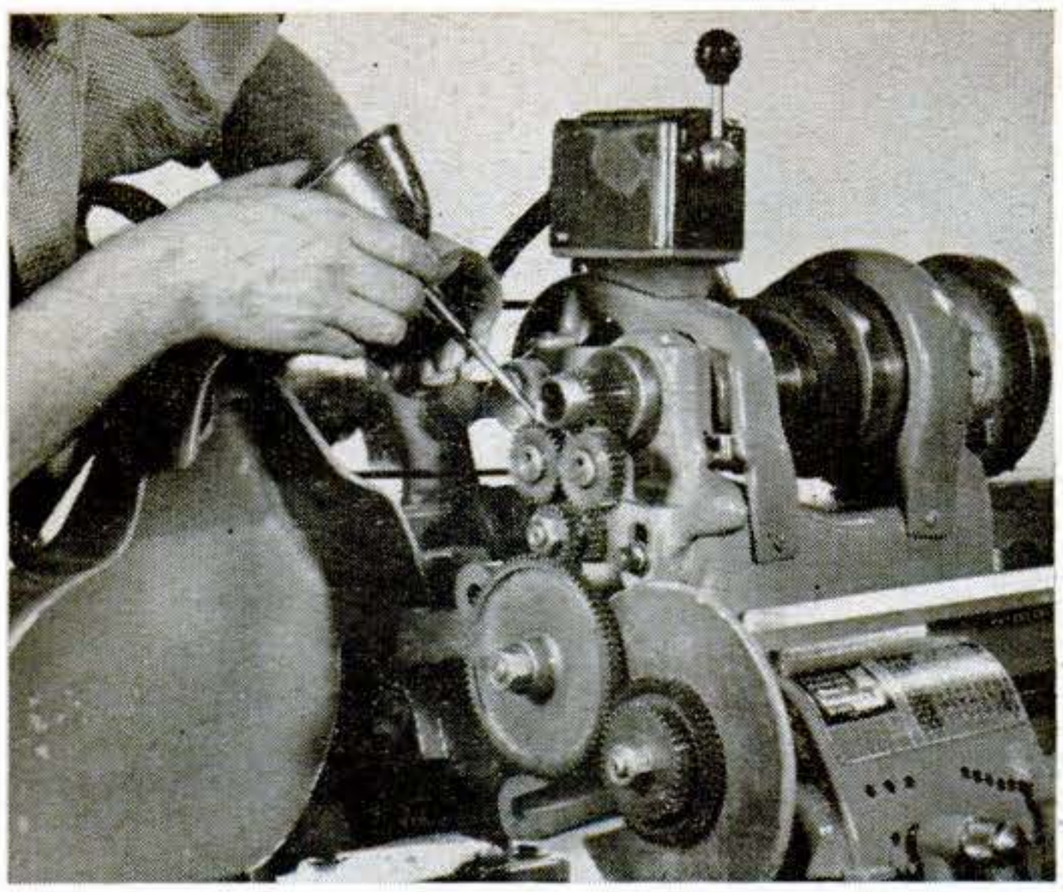
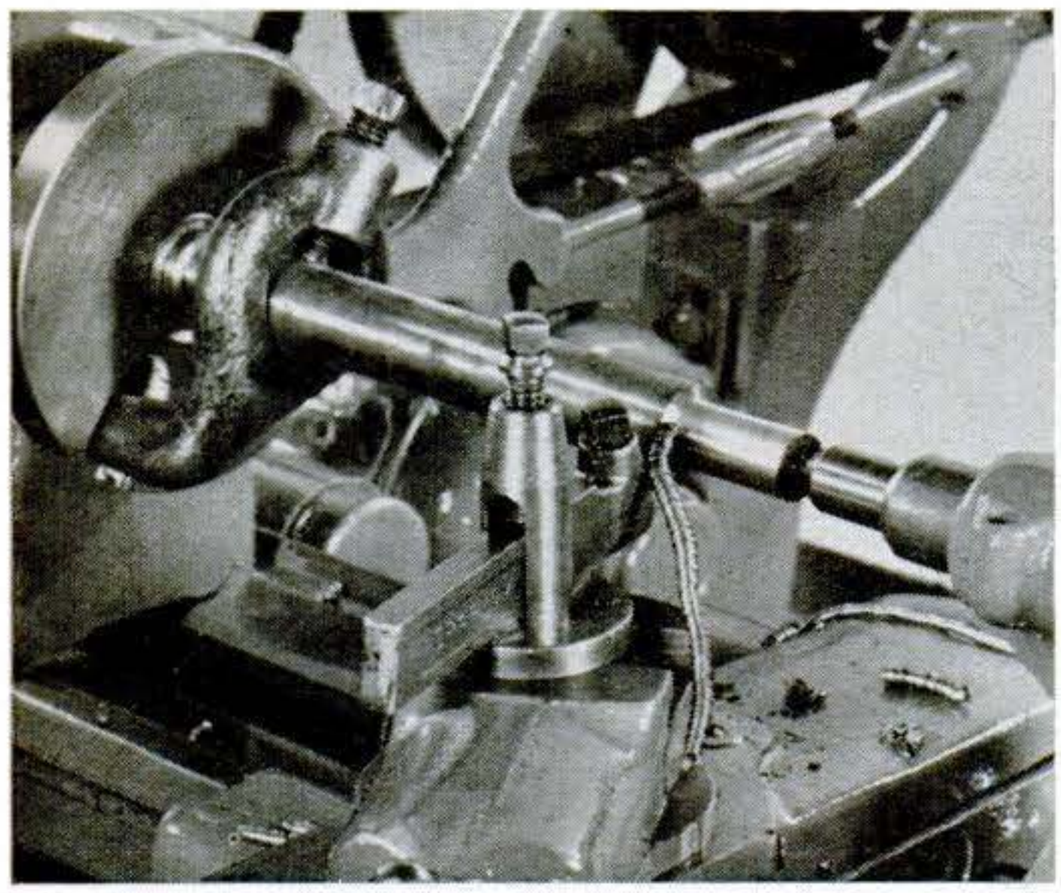
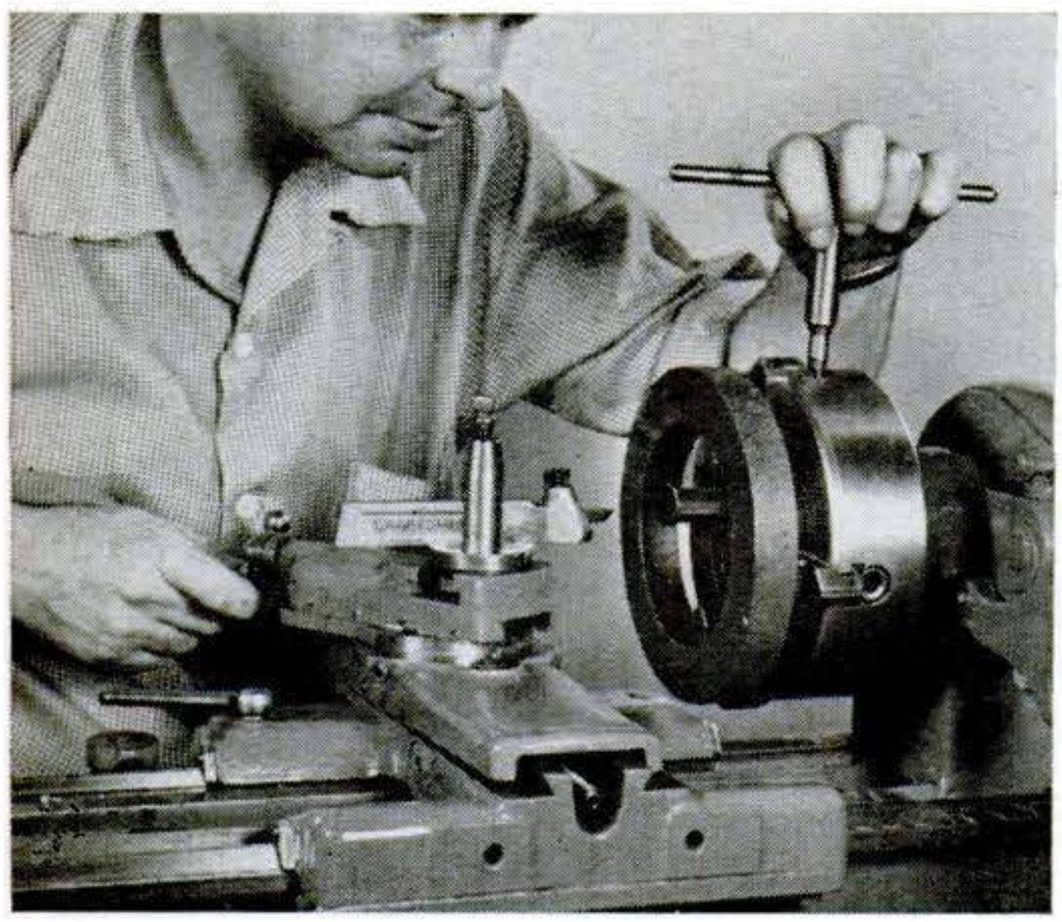


Gear train fixes the number of revolutions of spindle for each turn of lead screw. Ratio is changed by actually exchanging gears on some lathes, by quick-change gearbox on others.



Work turned between centers must have specially shaped center holes drilled in each end. A lathe dog clamped to the work, with its tail in a slot in the faceplate, drives the work.



Independent four-jaw chuck, which will grip work of almost any shape, is the most versatile of all work-holding devices on a lathe. The reversible stepped jaws screw up one at a time.

with three added features—two gear systems in the headstock and a sliding, precision-controlled tool carriage on the ways.

One of the gear systems, the back gears, is mounted just behind the lathe's spindle on an auxiliary shaft. Pull the lever that engages the back gears, and you "gear down" the spindle roughly 6:1. This provides the power needed for heavy cuts in large chunks of tough steel.

The second train of gears, this one driven by the spindle's outboard end, turns the lathe's lead screw, an Acme-threaded shaft that extends the length of the lathe bed just below the ways.

This lead screw drives the carriage. A heavy saddle-like casting, the carriage has a half-nut mechanism in its front apron that, with the throw of a lever, closes on the lead screw and power-feeds the sliding carriage along the ways. When this power feed is disengaged, the carriage can be wheeled in either direction along the ways with a rack-and-pinion handwheel.

A crank-operated dovetailed slide in the carriage casting provides crossfeed. The cross slide carries a second dovetailed slide, which, since it can be set at any angle, is termed a compound rest. The compound rest mounts a tool post that clamps a holder with a tool-steel cutting bit. Together, the carriage handwheel, crossfeed crank, and compound-rest crank control the cutting bit with gnat-hair precision.

That's the basic mechanism. There are many versions of it—the many makes, sizes, and models of lathes available.

South Bend, Logan, Atlas, Craftsman, Delta, and American Edelstaal are the leading brands of small metal lathes suitable for home shopwork. Each offers machines in several sizes.

The usual measure of lathe size (the diameter of the largest piece of work the machine will turn) is only generally descriptive. One 12″-swing lathe may be an inexpensive tool designed for light work, another twelve-incher may be an industrial tool with many special features and a startling price tag.

Lathes of given size are available in either bench or floor models.

Bench lathes with swings of 6″, 9″, 10″, and 12″ are supplied with separate speed-changing countershafts that mount on the bench behind the tool's headstock. A 6″ bench lathe costs about $200. Prices on 9″ to 12″ bench lathes start at about $350.

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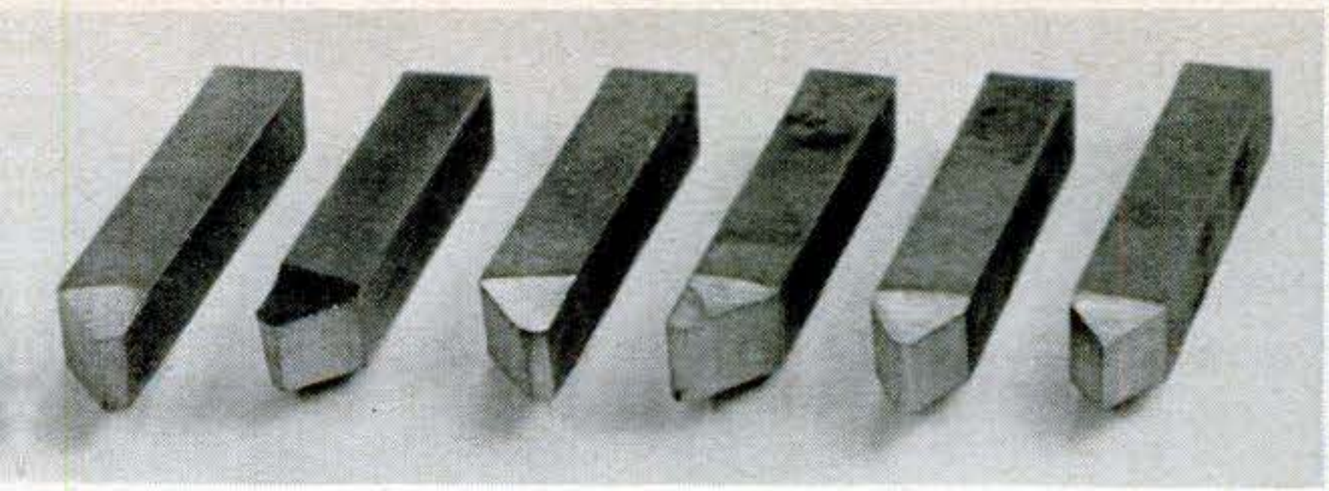
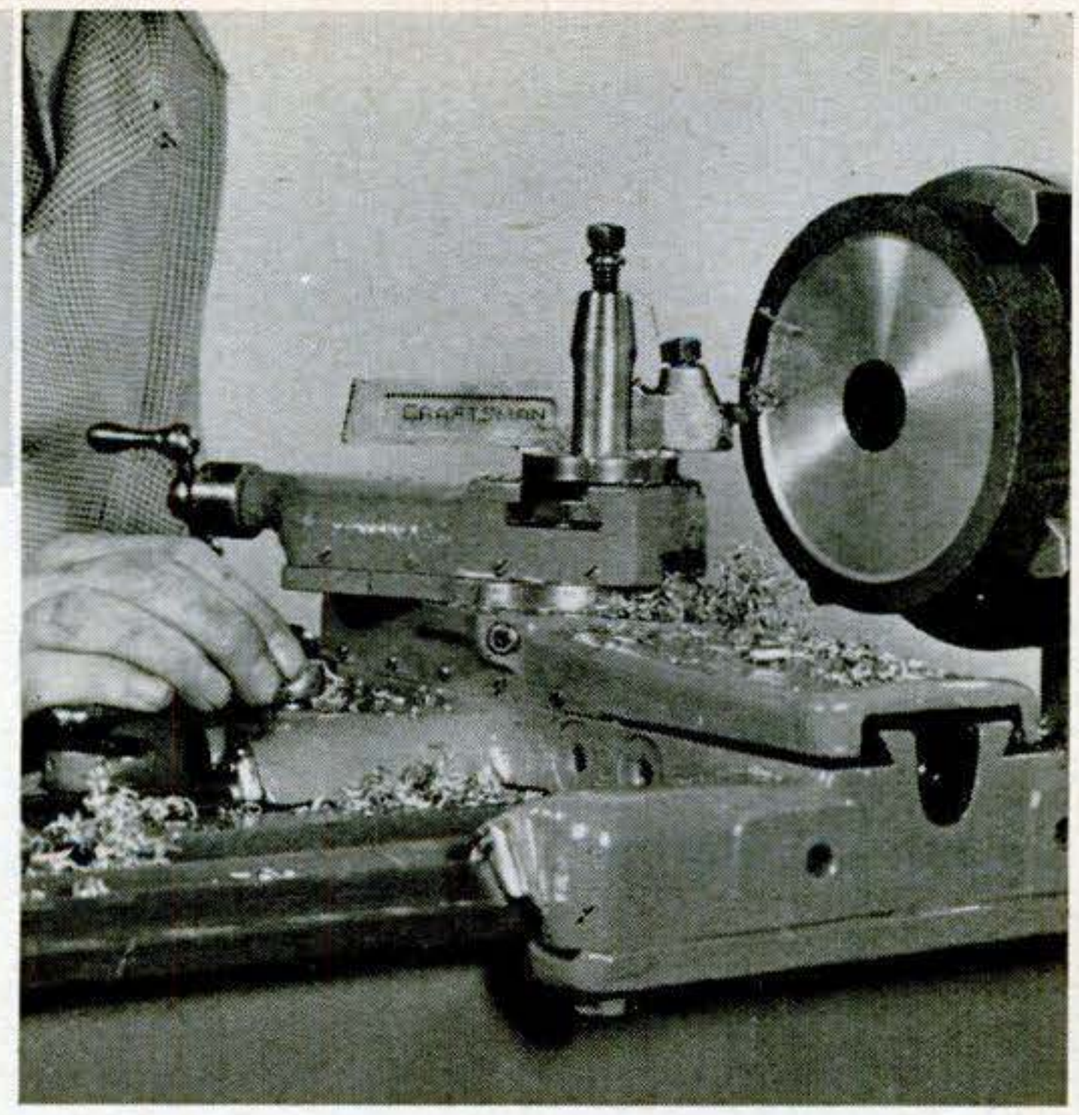
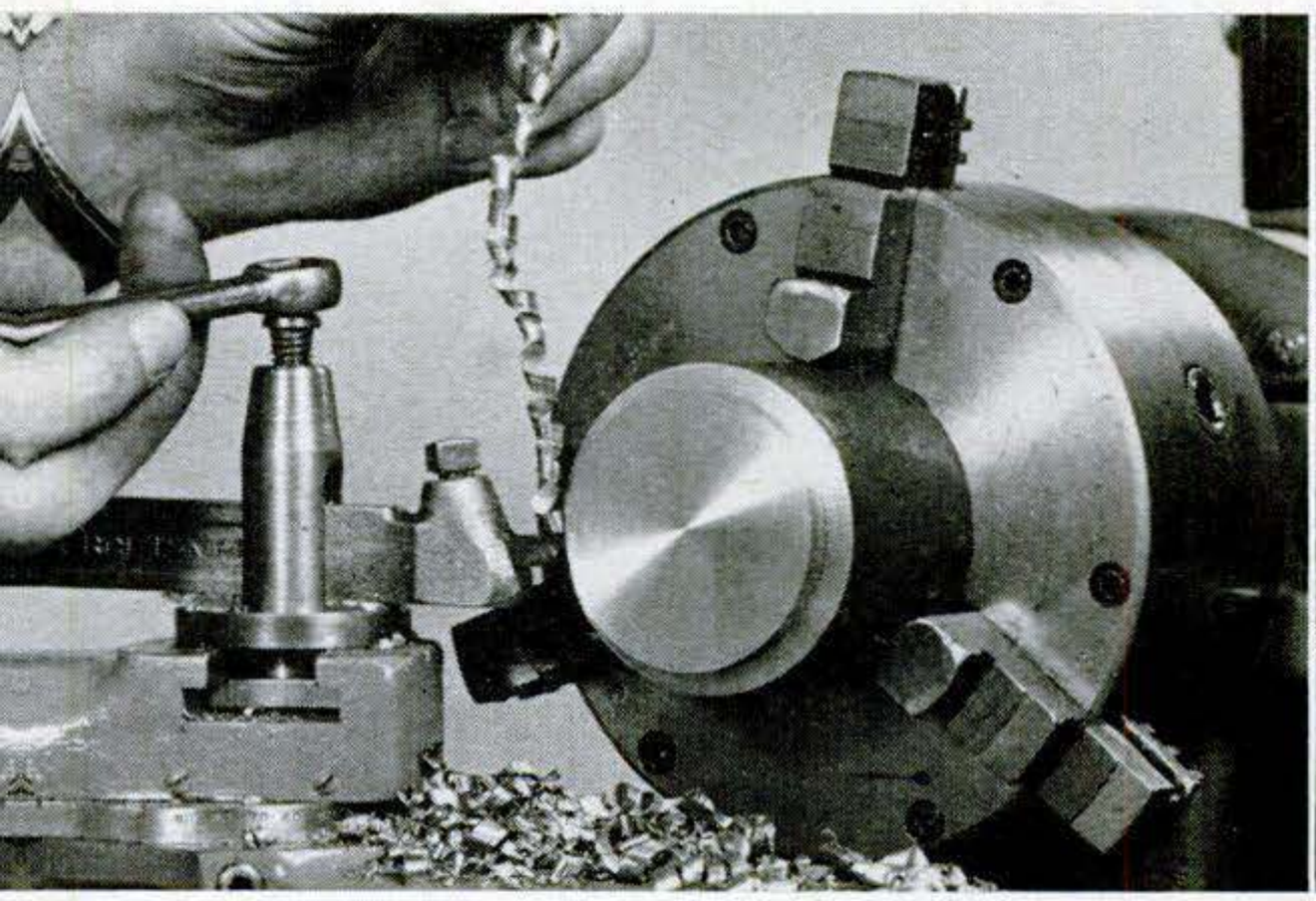


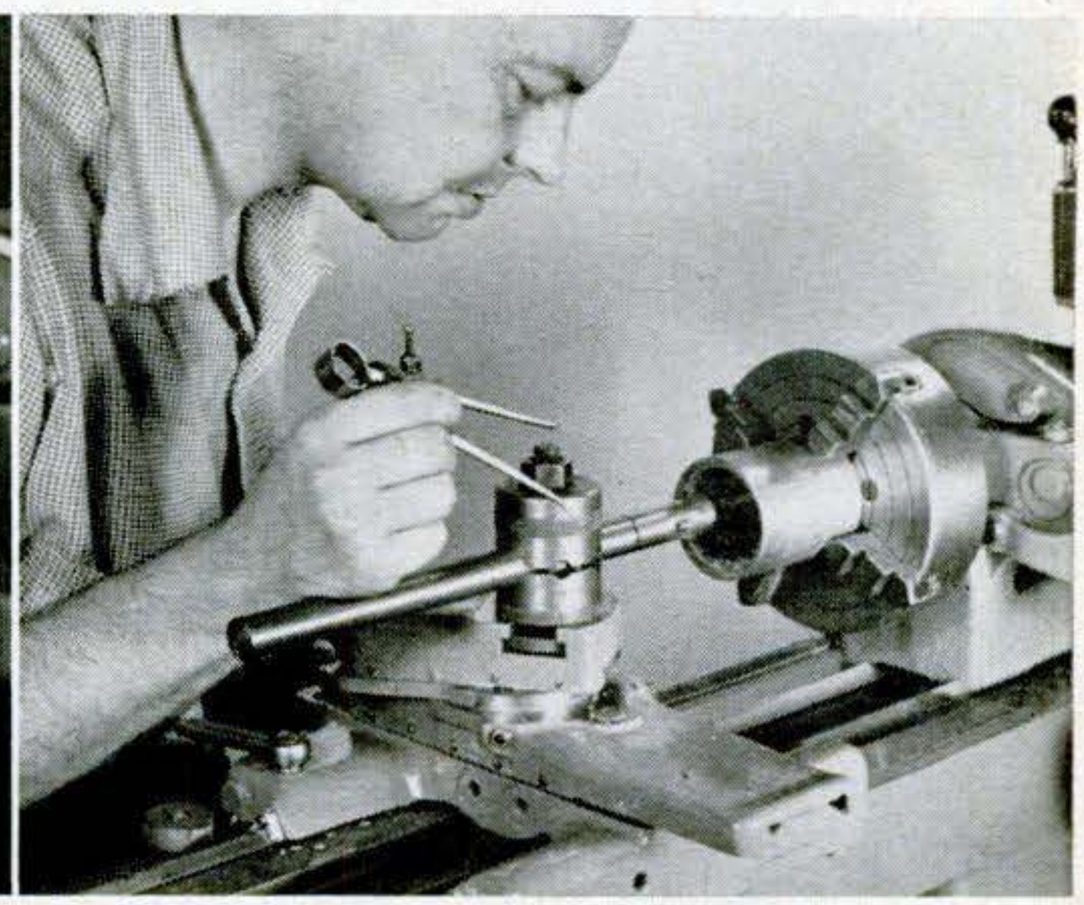
Tool bits are ground to suit each kind of cut. Most small lathes use ¼″ square bits. Shown (left to right): left- and right-hand facing bits, left- and right-hand turning bits, round-nose finishing bit, thread-cutting bit.

Facing cuts are made by locking carriage and moving tool across work with the crossfeed. Usually cut is made from center out. Some lathes have power crossfeed; others are cranked by hand. Short tapers are cut by setting compound at desired angle and feeding with it.

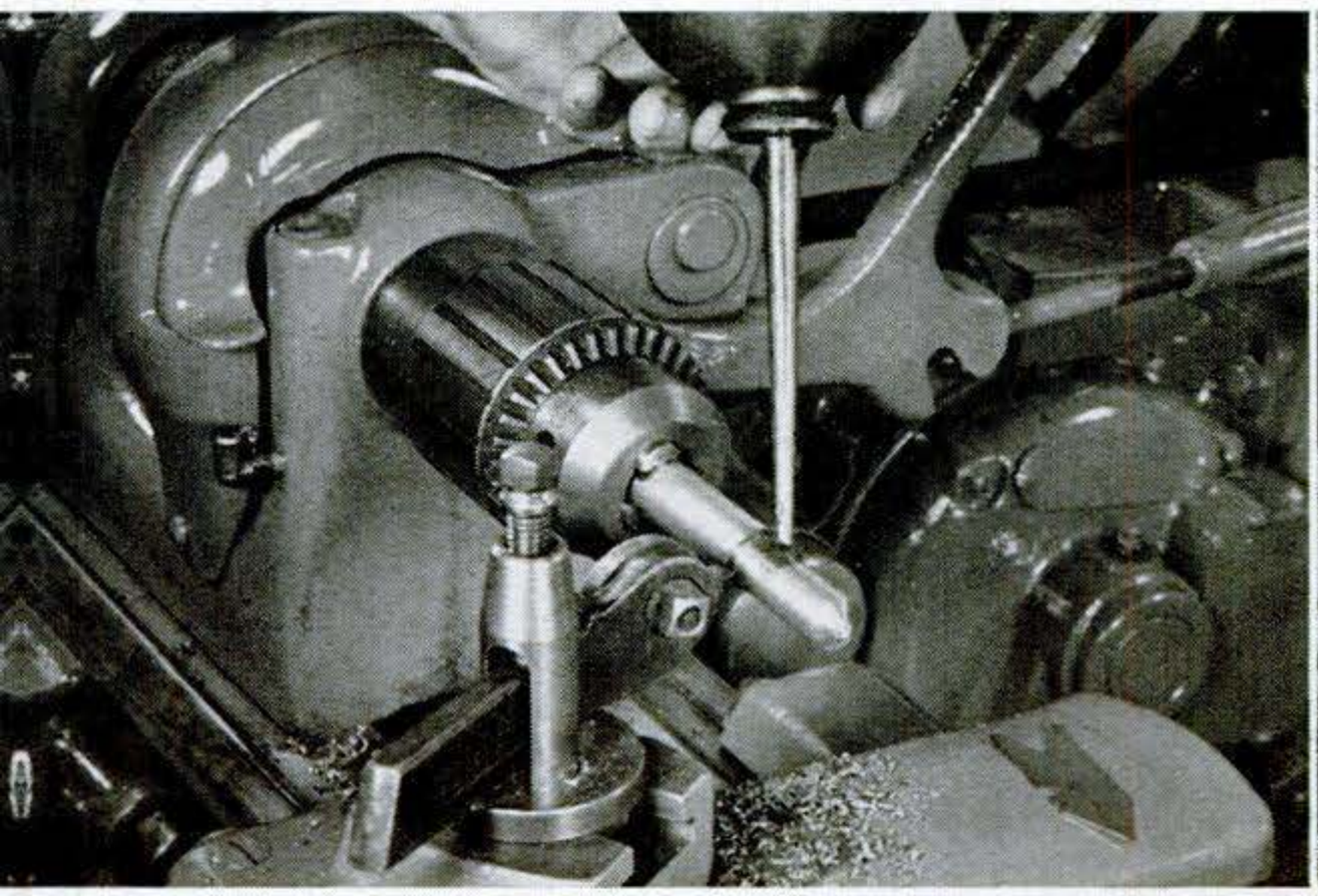




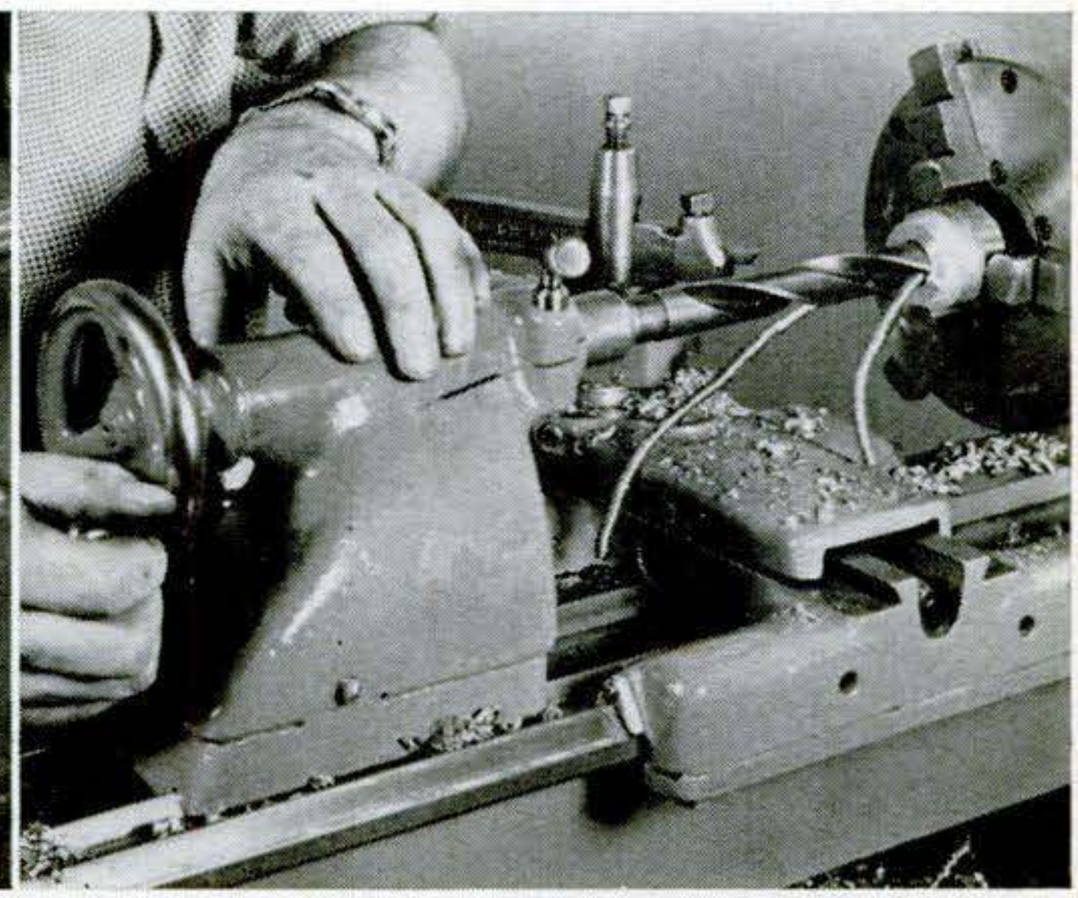
Heavy roughing cuts like this are made to reduce stock to within a few thousandths of finished size. Final diameter is obtained with a light, high-speed, fine-feed finishing cut.



Boring bar is used to machine inside larger-diameter holes. Some are forged in one piece and are held in ordinary tool post; others use inserted tool bits and have their own holder.



Screw threads of almost any description can be cut with single-point threading bit. Change gears are chosen to give positive longitudinal feed equal to pitch of the desired thread.



Precision drilling is done on the lathe by feeding drill (held stationary in tailstock) into rotating workpiece. This is usually the method used for center-drilling a workpiece.

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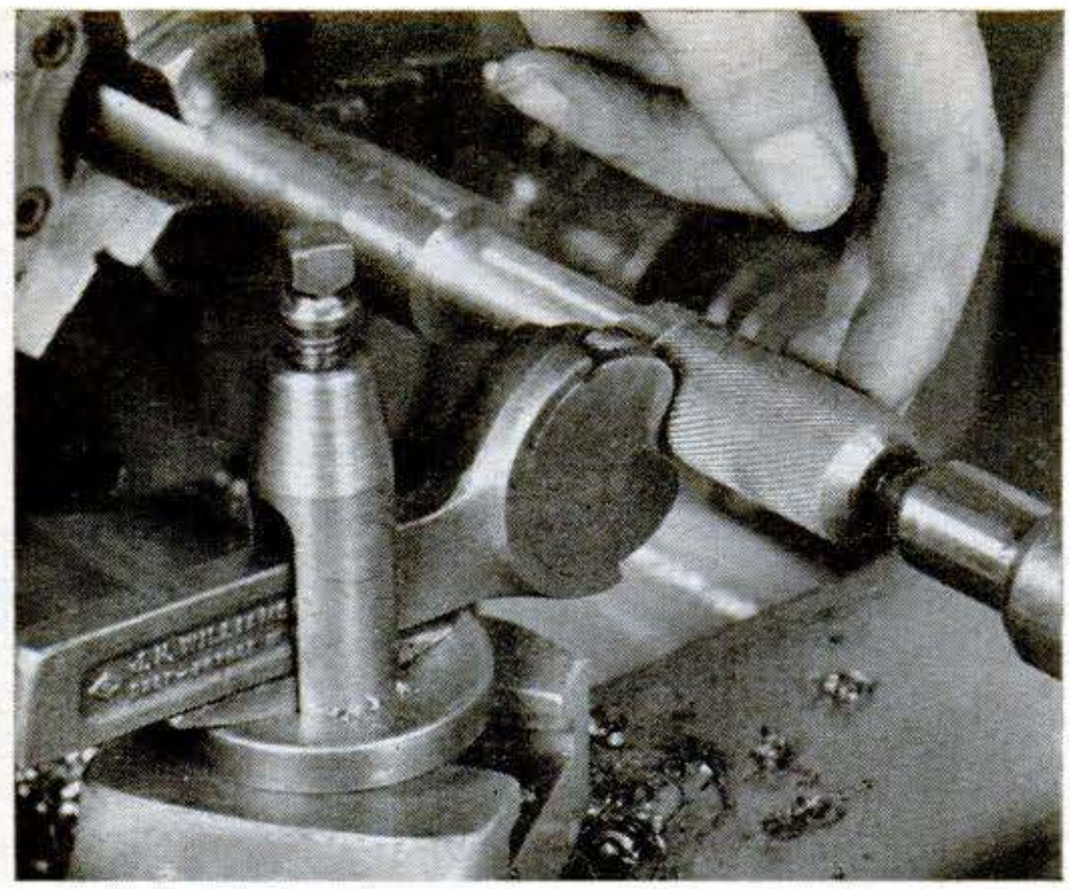
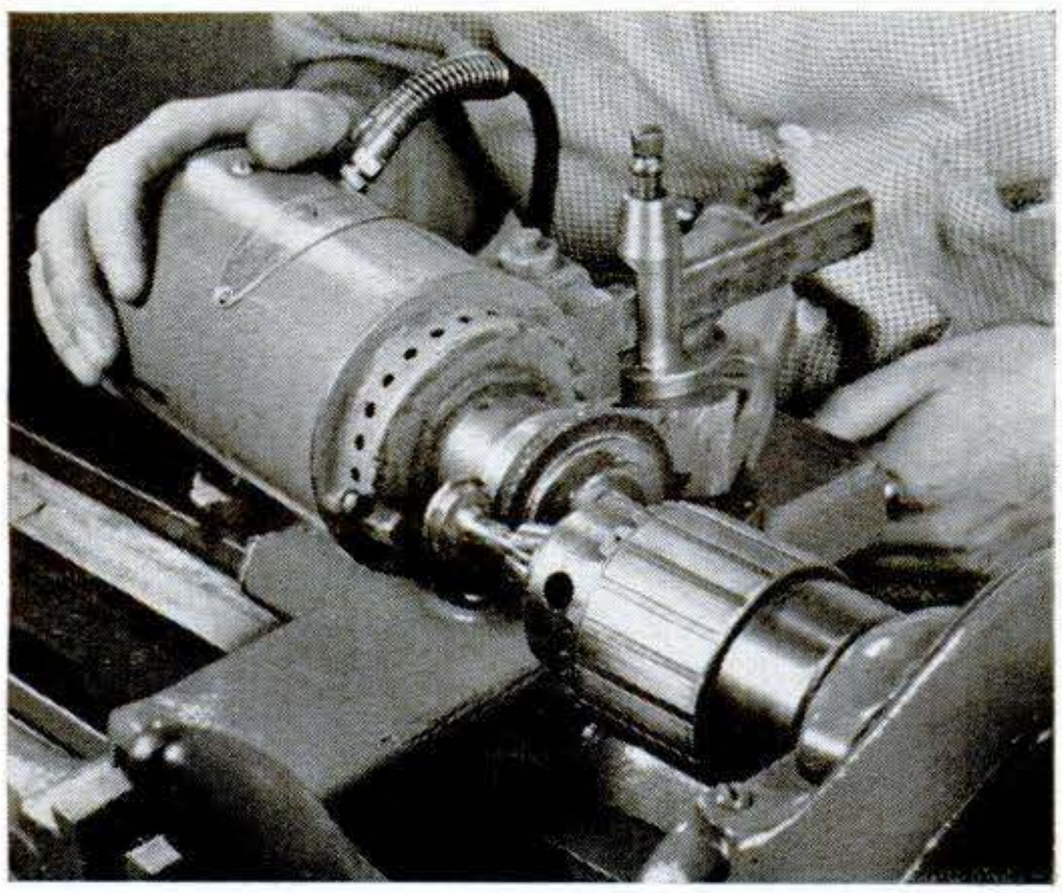


Knurling is done with a tool having two serrated rollers that impress a diamond-shaped pattern when forced squarely against the work. Power feed moves tool along work.



Tool-post grinder, mounted in place of cutting tool, is used to put a precision-ground finish on hardened steel. This is the best way, for one example, to face auto valves.

Bed ways are finished to a high degree of precision and a good machinist never risks damage by laying tools or work on them. A wooden tray affords convenience, protection.

The least-expensive 9″ to 12″ bench models are plain-change lathes, so called because headstock gears are changed manually to vary the power feed. Other models in this size range have one or more of several extra-cost features, each of which ups the price roughly $100.

The extras. One such feature is an automatic apron—a carriage apron equipped with a clutch-governed power crossfeed as well as longitudinal feed. Another extra is a quick-change gearbox something like a small auto transmission that permits changing power feeds without manually changing headstock gears. A long-length bed is another. Hardened ways, another.

These same 9 to 12″ machines can also be had mounted on welded-steel, pedestal-type cabinets that completely enclose the motor and countershaft. Floor lathes hit the $700-900 price range—and go up considerable when you get into top-quality toolroom models.

Obviously, then, good lathes aren't cheap. Yet they're not as expensive to own, really, as their catalogue prices would indicate, since lathes hold their value.

Kept clean and oiled, a lathe never wears out, and it's always easy to sell a good used machine. A small lathe depreciates some 20 percent in its first year. A five-year-old tool in good shape sells for approximately 60 percent of its original price. A serviceable 10-year-old is still worth 50 percent of its cost. The per-year cost of owning a good lathe is only some $25, more or less.

What model should you buy? If you want a tool for occasional home shopwork, a minimum-cost plain-change bench lathe will be adequate for any job you'd want to tackle. If you plan to use your lathe commercially, however, a floor model with an automatic apron and timesaving quick-change gearbox will be worth the added cost.

The 28″-high bench for a lathe should be built like Gibraltar, since any twist in the bench will also twist the bed slightly and cause the machine to cut a taper. It's important to level a lathe accurately when setting it up, shimming the legs if necessary and checking along and across the ways with an accurate machinist's level.

Turning any piece of work in a lathe poses two problems—how to hold the work, and how to cut it.

Long work that will be turned its full

[*Continued on page 192*]

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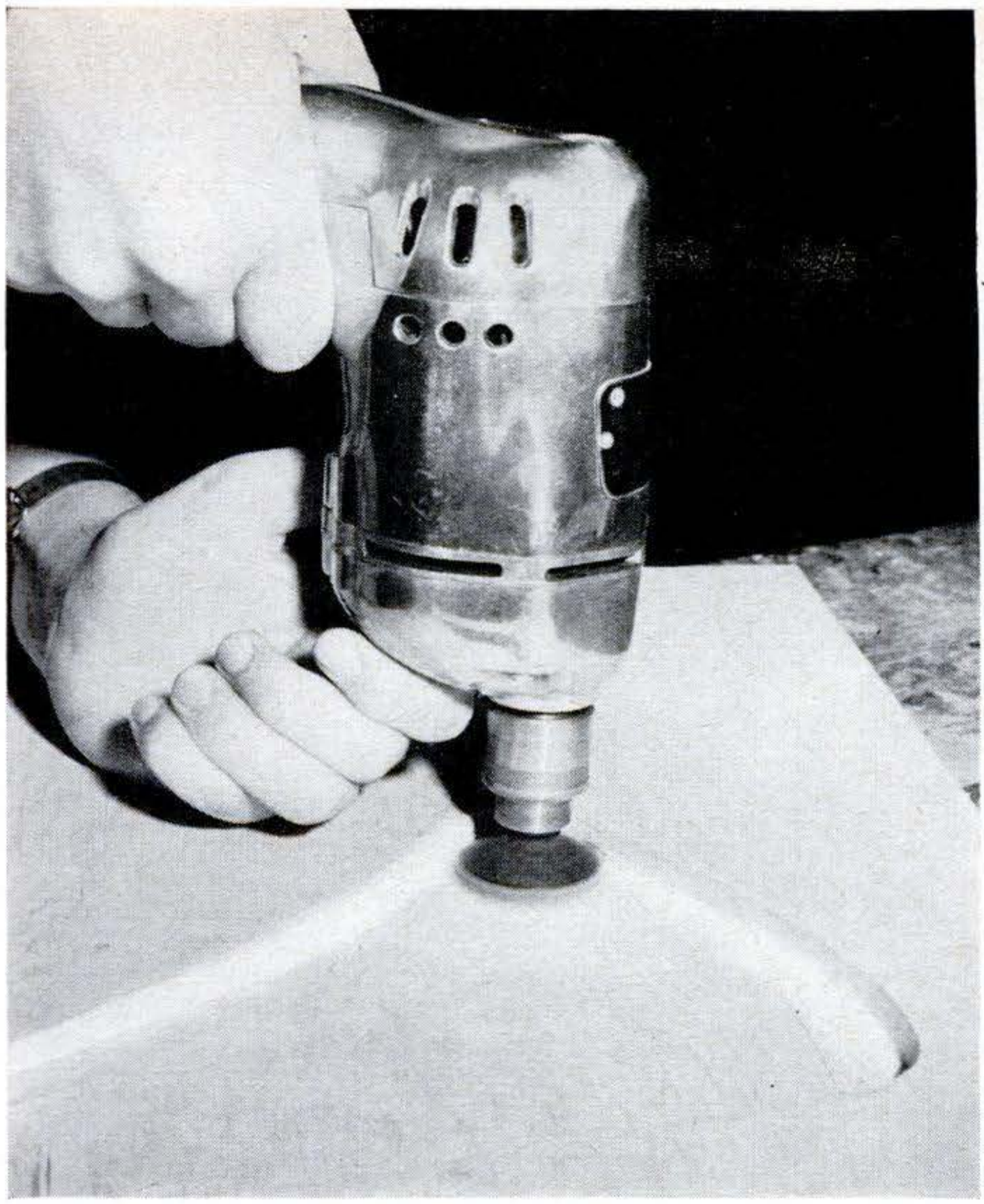
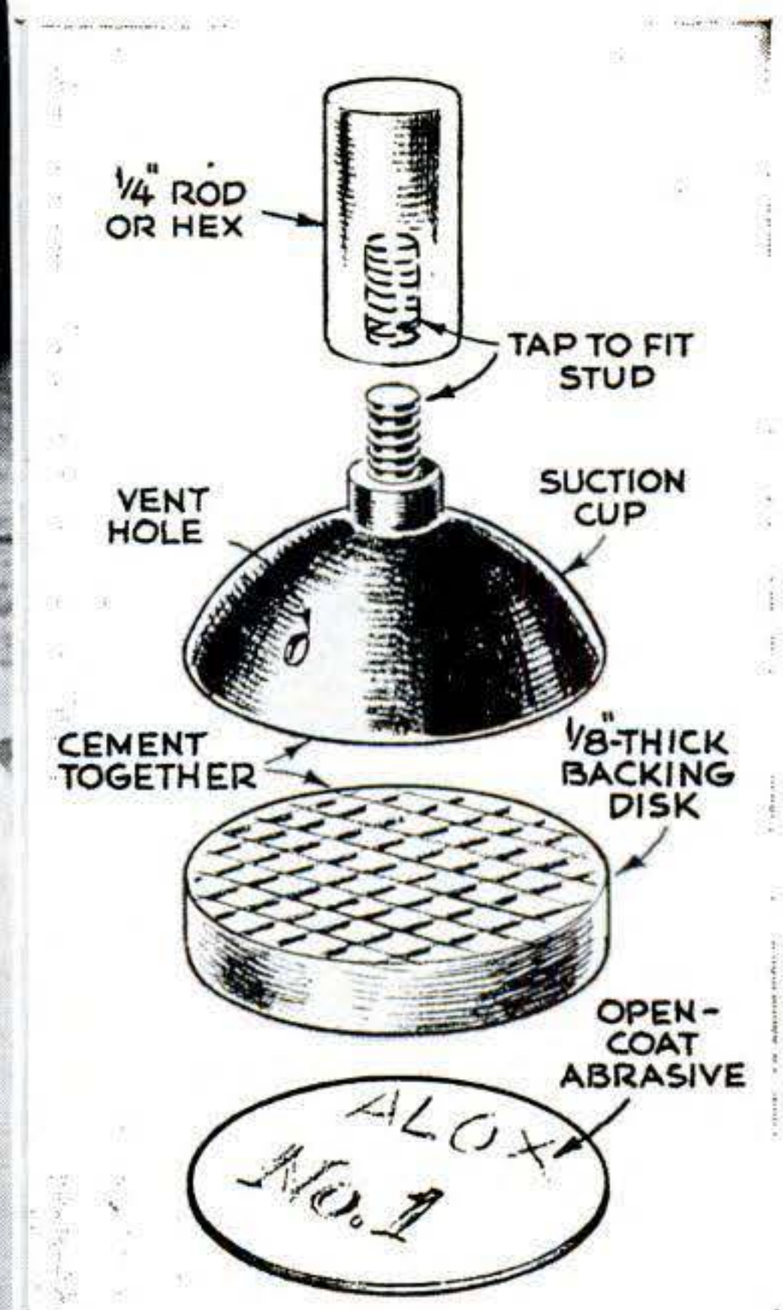
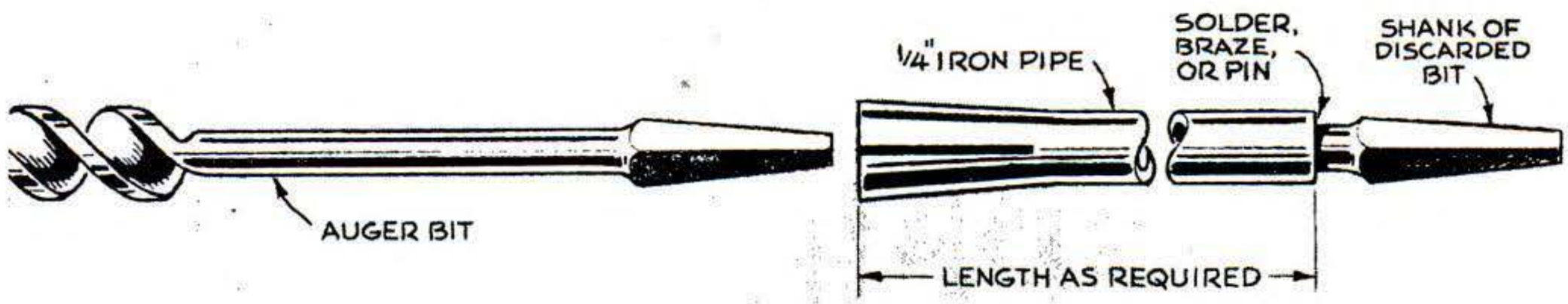




Midget sander for close quarters

To smooth a routed area on a board, I made my own sanding accessory when I couldn't buy one small enough. Chucked in an electric drill, it smoothed the inside contours in jig time. The secret: It's built on a rubber suction cup. The rubber provides cushioning plus enough flexibility to make good contact, even on rough surfaces.

I used a cup with a threaded stud molded in, and punched a hole in the rubber to vent the cup. For the backing disk, either plywood or hardboard is fine. The abrasive disks are cut by scoring a circle with dividers and tearing along the scored line. I coated the backing disk with sanding-disk cement, so it would be easy to peel off the paper. The stud on the suction cup screws into the threaded sleeve mounted in the chuck of my electric drill.—*Harry Walton, White Plains, N. Y.*



Make-do auger extension

The last time I needed to bore through partitions for an electrical outlet I lacked a drill extension, so I decided to make my own out of ordinary ¼" iron pipe. I clamped one end in the brace; the other end I shaped to form a socket clamp for the bit. I did this by heating the end and clamping it in a vise. Then I drove it over the shank of the bit until it took the required shape. —*Archibald Black, Stafford Springs, Conn.*

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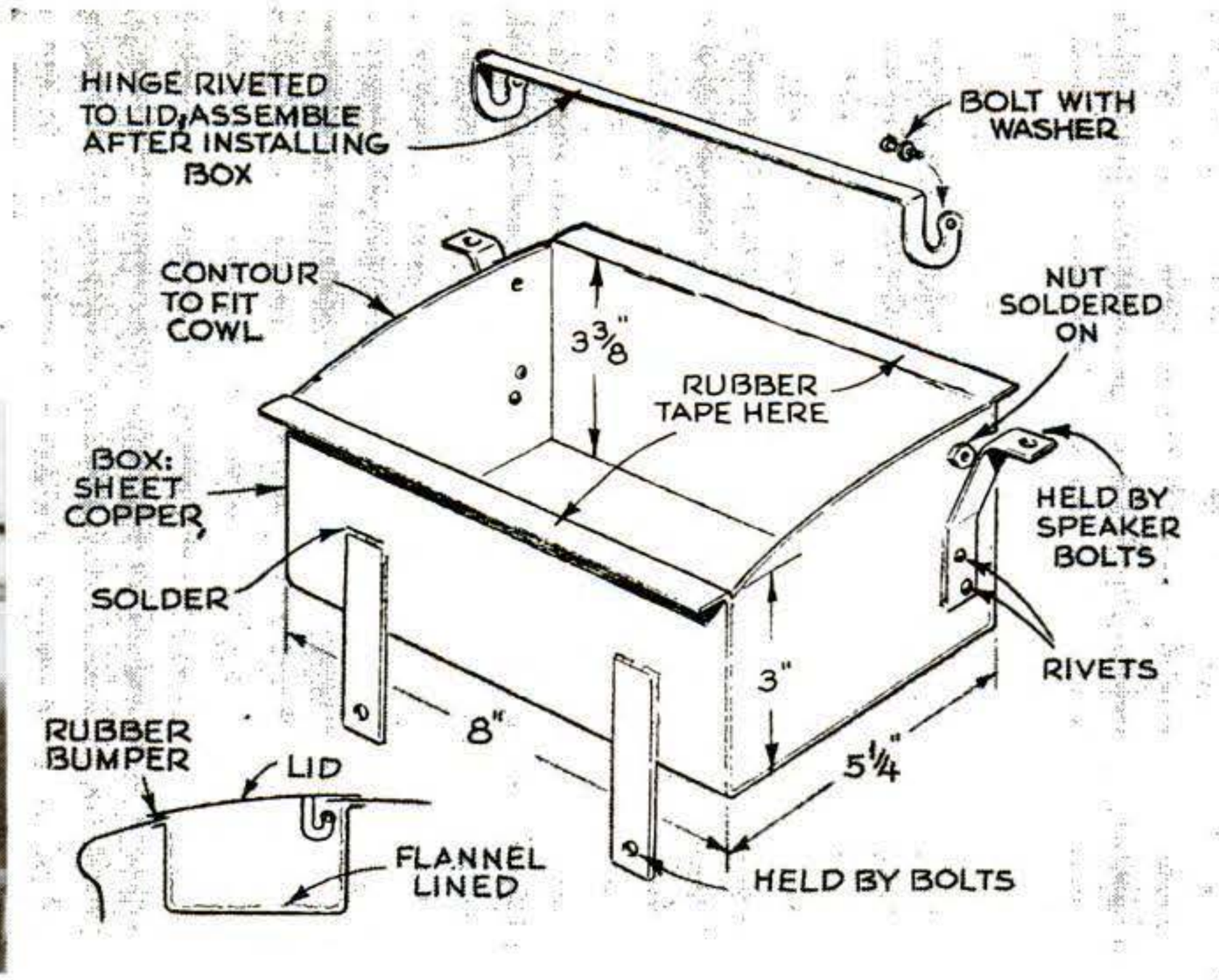
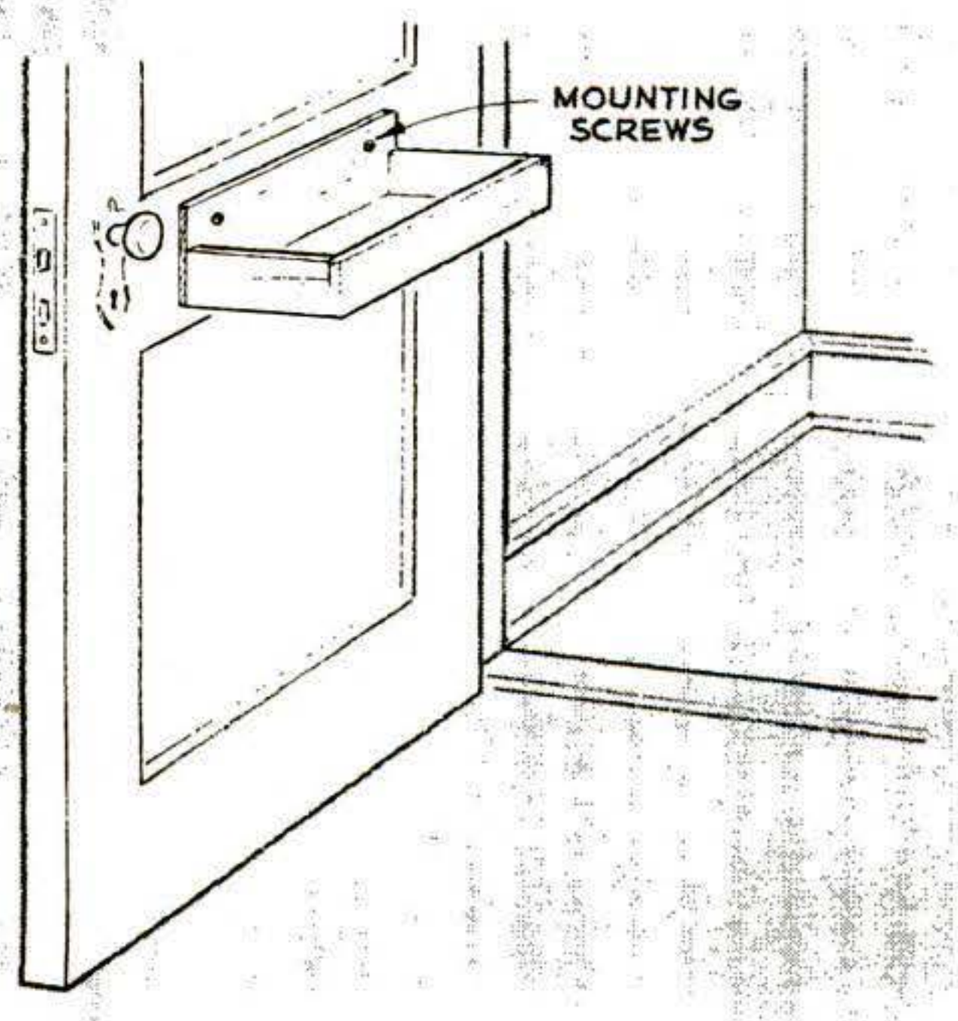
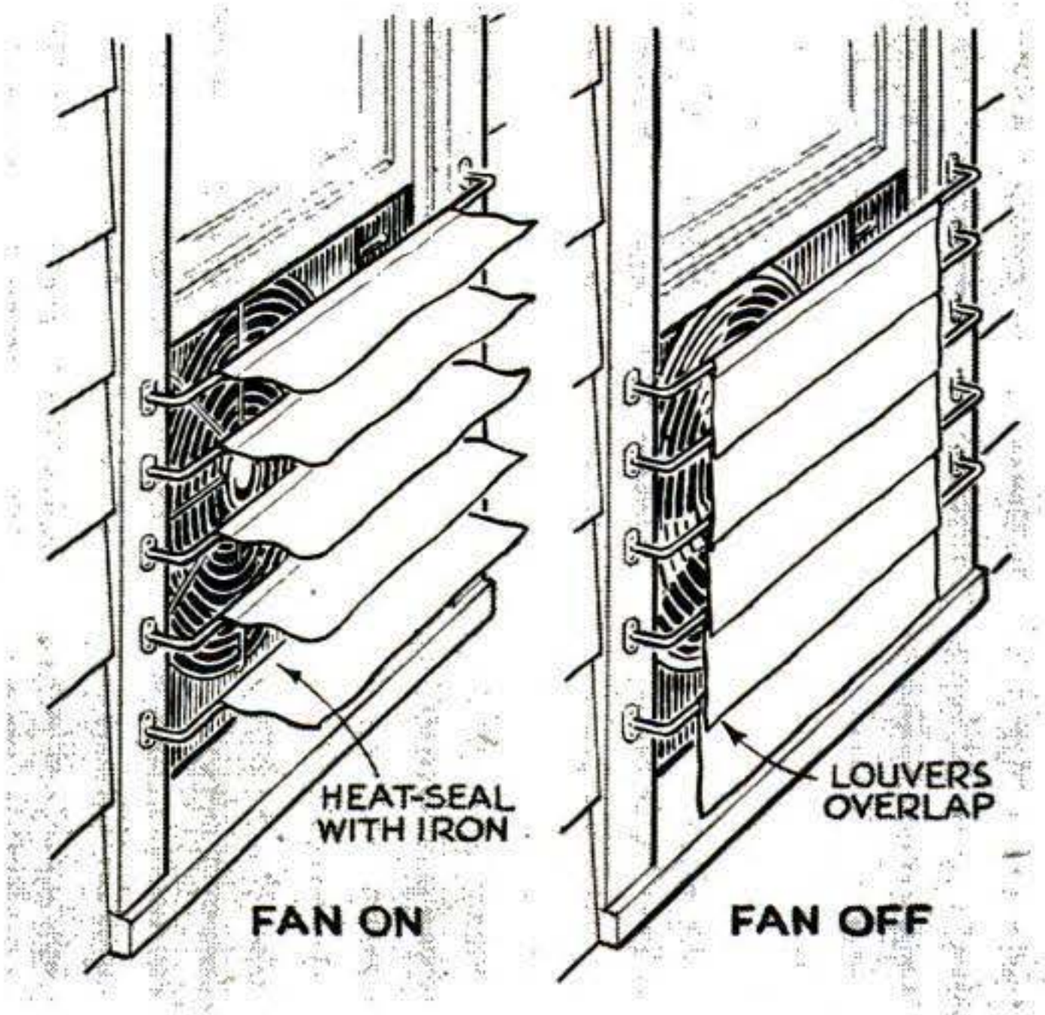
Short Cuts and Tips | FROM PS READERS



Cowl tray for hidden storage

Instead of a radio, I installed this cowl tray in my car. It's a handy place for cigarettes, extra change, and all the stuff a driver thinks he needs. I made the lid of the tray out of 20-gauge steel and painted it to match the car finish. It's supported on bumpers to prevent rattling. The tray is made of sheet copper. I lined mine with heavy cotton flannel, but any soft material will do for deadening sound. I riveted a concealed hinge to the lid and bolted it to the car.—*E. H. Horr, Hickory, N.C.*





Door container holds odds and ends

To provide additional storage space in our boy's room, we added a boxlike shelf to the inside of the closet door. It takes care of such items as bow ties, cuff links, watch, and pocket odds and ends. I cut out the box from ¼" plywood and screwed it to the middle rail of the door. To hold belts and ties, I screwed hooks and a dowel to the underside of the box.—*Anne Capasso, Hempstead, N.Y.*

Guard protects exhaust fan

Our kitchen exhaust fan got wet in heavy rains until I found out how to protect it without interfering with the exhaust stream. The secret: plastic louvers (cut from an old shower curtain) suspended from curtain rods. With the fan going, the louvers blow out of the way. With the fan at rest, the overlapping louvers fall back, shielding the fan from wind and rain.—*J. C. Remsen, Brooklyn, N.Y.*

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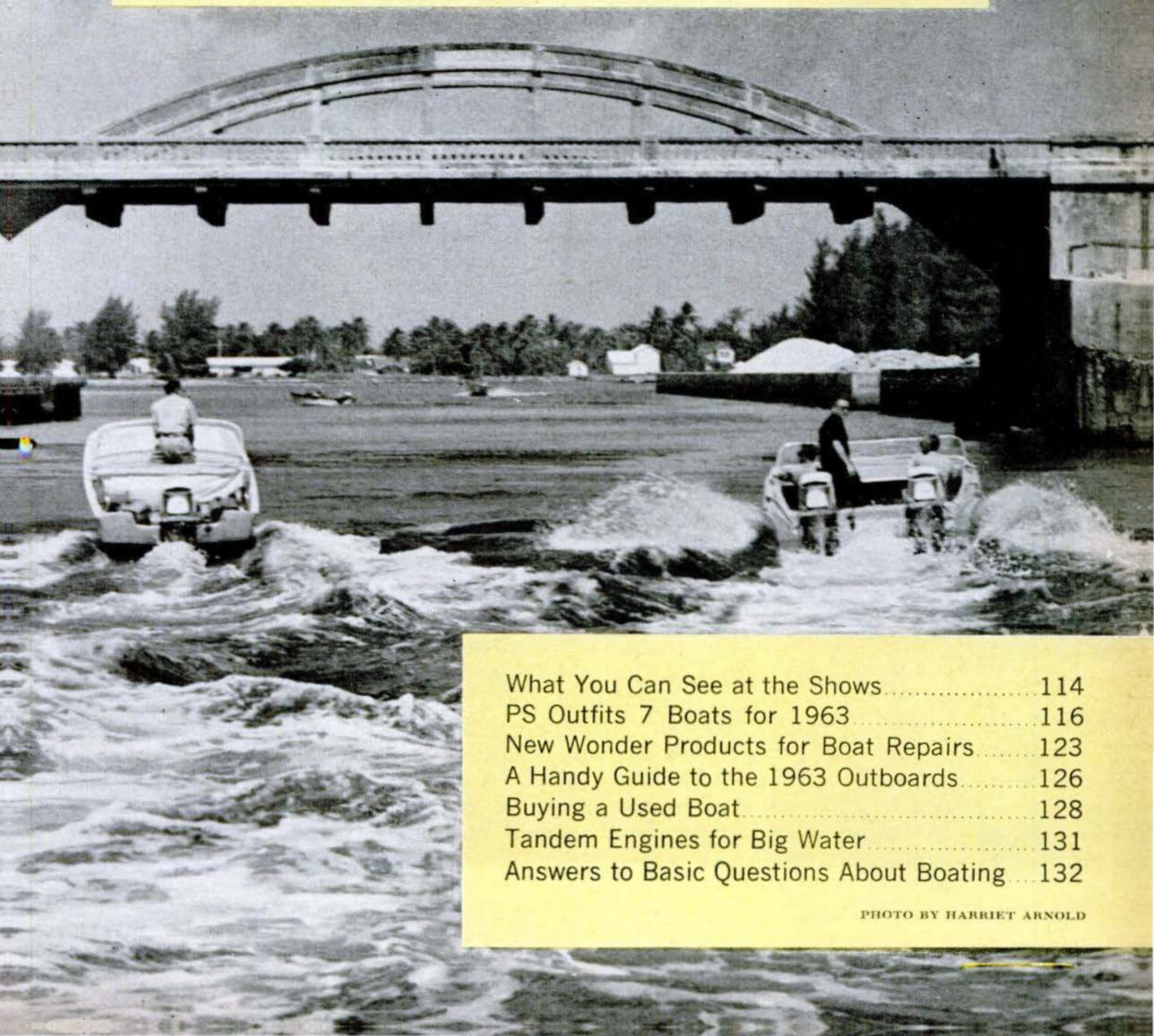
PS BOATING

What's New for Boating in '63

22 pages of news about boats, motors, and the equipment you need, or would like to have, for fun afloat

By Jim Roe PS BOATING EDITOR



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PS Outfits 7 Boats for 1963 116
New Wonder Products for Boat Repairs 123
A Handy Guide to the 1963 Outboards 126
Buying a Used Boat 128
Tandem Engines for Big Water 131
Answers to Basic Questions About Boating 132

PHOTO BY HARRIET ARNOLD

WHAT'S NEW FOR BOATING IN '63

This is the season for boat shows. All over the country, boat and equipment makers are putting on eye-popping displays of their newest, brightest wares—displays guaranteed to turn your thoughts these wintry days to sun-dappled expanses of blue water, to swimming off a deserted shore, to fishing in quiet coves, to family picnics, to evening cruises, to swift rides across a sparkling lake, wind in your face. Such thoughts are brought to mind by a visit to one of the many shows, and you'll want to go in person if you can. But if you can't, come along now with Boating Editor Jim Roe for a look at important items available this year.

1. CRESTLINER CAPTAIN'S GIG

2. CUSTOM CRAFT CATAMARAN

3. POWERWINCH

4. O'DAY JAVELIN

SEVERAL boatbuilders have come up with unusual control stations this year. You'll find one in Crestliner's 18-foot Captain's Gig (photo 1). This interesting-looking boat has a centrally mounted driver's seat with space to front, rear, and sides. I've never personally driven a boat from this position and can't say how it feels. But it looks as if it might be fun. The boat is a soft-entrance planing hull of molded lapstrake fiber-glass. A 100-hp. Interceptor inboard with direct drive and hydraulic transmission propels the boat, Crestliner's first inboard, at speeds up to 28 m.p.h.

The trend to new-type hull designs seems to be growing. POPULAR SCIENCE had a roundup of these hulls last August and has made tests of two of them within the past year or so. [See "Dreamboat for Everybody," Feb. 1962, and "Jim Roe Tests the Bertram," Jan. 1963.] Now we find among the new hull types the four-point catamaran (photo 2) offered by Custom Craft. The slender hulls are designed to slice through the water without pounding. Concave intake tunnels create lift, help keep the boat dry. This boat rides with a minimum of wetted surface, yet without cavitation. She's an exciting boat, and handles well on straight going or turns.

The lady (in photo 3) is not an auto mechanic. She's just illustrating how easy it is to hook up a Powerwinch. These winches have been on the market for several years. I have used one for three seasons to the benefit of both my aging muscles and my temper. In this day of mechanical marvels, it's downright old-fashioned to crank a heavy boat uphill onto its trailer by sheer strength and awkwardness. It's much easier to hook into your car's electrical system, tug the lanyard switch of the Powerwinch, and see the boat come meekly and effortlessly out of the water.

As a safety precaution, I recommend that you stand to one side, out of the way of the cable. I've hauled too many sling loads of hay into the mow ever to be at ease directly in line with a rope or a cable under tension. The Powerwinch lets you do it all with no effort and well to one side. And a new system of using a portable power cable gives you the option of wiring into your car's electrical system permanently or simply clamping the power line onto the battery when you wish. Great for the man who wants to use his winch with any of several cars.

Despite the boom in powerboats, many folks prefer to use

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wind for locomotion, and are often vehement in their preference for dacron or nylon over the internal-combustion engine. Some of these sailors cross oceans singlehanded in small boats. Some assemble a crew and race to places like Bermuda, Hawaii, and Mackinac. But many of them think the finest sport of all is to take a small boat just offshore and pit one's skill against the winds and the calms.

They are particularly fond of boats such as the O'Day Javelin (photo 4). This staunch centerboard sailer is a stable-temperament 14-foot craft. Of easily maintained fiberglass, she has a self-bailing cockpit that helps take care of the drainage if she heels over a mite too far in a blow. She is easily trailered, and has lift-out seats that open her cockpit for picnics, day sailing, fishing, or cruising. She weighs but 450 pounds, has a sail area (including main and jib) of 125 square feet. Complete except for sails, she sells for $1,195 f.o.b. Boston.

That boat up at the top of the page (photo 5) is the fabulous-performing Fabuglass. As you can see by the flat-out spray, she can really move. The thing that's doing it is a MerCruiser 110-hp. stern drive. Tucked neatly under a stern housing, this herd of horses can take you across the lake and back in one big hurry.

Jet drives came on the market with a woosh several years ago and have steadily won the hearts of a devoted group of boatmen. The Buehler jets—which dazzled us all with their full-speed 180-degree turns and their performance on little more than a heavy dew—are still going strong. One 1963 model, an 18-footer with a three-stage Turbopower jet unit gets up to 38 m.p.h. Built-in stern ladders with step plates are an integral part of the jet unit and emphasize the jet's safety to swimmers—they can come in right over the drive unit. A jet drive that's hard to beat is the Berkeley. We tested it on the Green and Colorado rivers [see PS August, 1962], and it was a magnificent performer.

The Jacuzzi jet (photo 6) has a safety-action rudder to help stabilize the boat in tight turns. This rudder automatically tilts up flush with the hull when it hits bottom or debris. It is also designed to give greater steering control at slow speeds, or even with the jet off as the boat coasts.

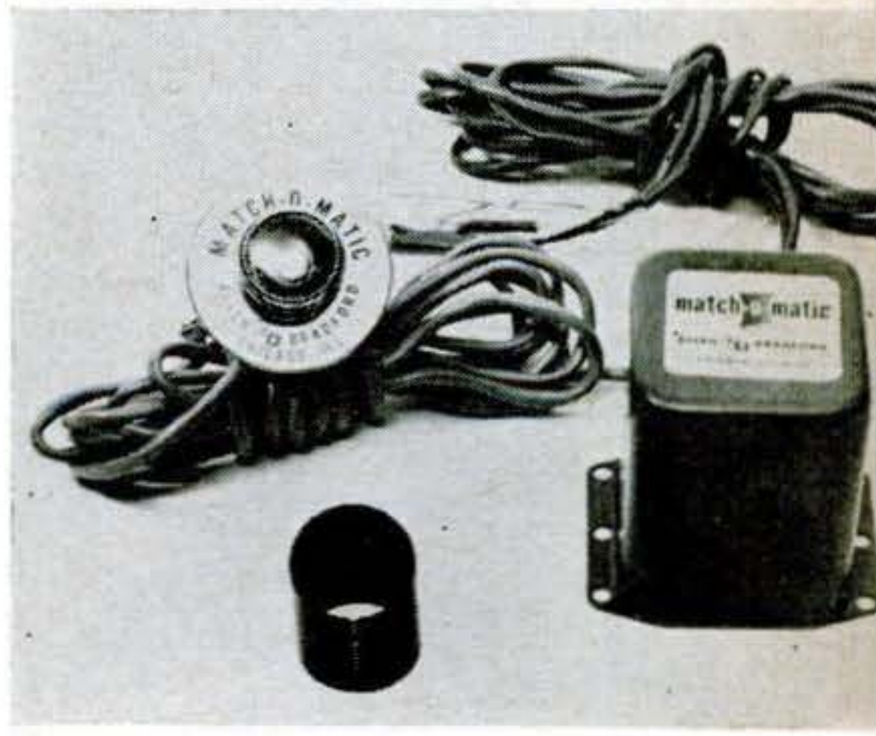
A handy gadget to make sure both sets of horses—either inboard or outboard—are pulling together is the new improved Match-O-Matic twin engine synchronizer (photo 7) offered by Chicago's Instr-O-Matics (formerly Allen-Bradford). Synchronized engines help with fuel economy and eliminate dragging, which pulls the boat off course when one engine is not putting its shoulder into the harness quite as much as its partner. This particular instrument needs no batteries or switches. It operates as the engines operate. The model A lists at $29.95. The model B, especially designed for high-speed V-8 motors with 12-volt coil systems, is $39.95.

Out in California the Glasspar people have been hard at work designing high-performance boats. One pride of their fleet is the '63 Seafair Sedan (photo 8). This is a 17½-foot cabin cruiser that sleeps two. It has some good safety features including a self-bailing motor well. The fiber-glass

[Continued on page 134]

5. FABUGLASS WITH MERCRUISER

6. JACUZZI JET



7. MATCH-O-MATIC SYNCHRONIZER

8. GLASSPAR SEAFAIR

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PS Outfits 7 Boats

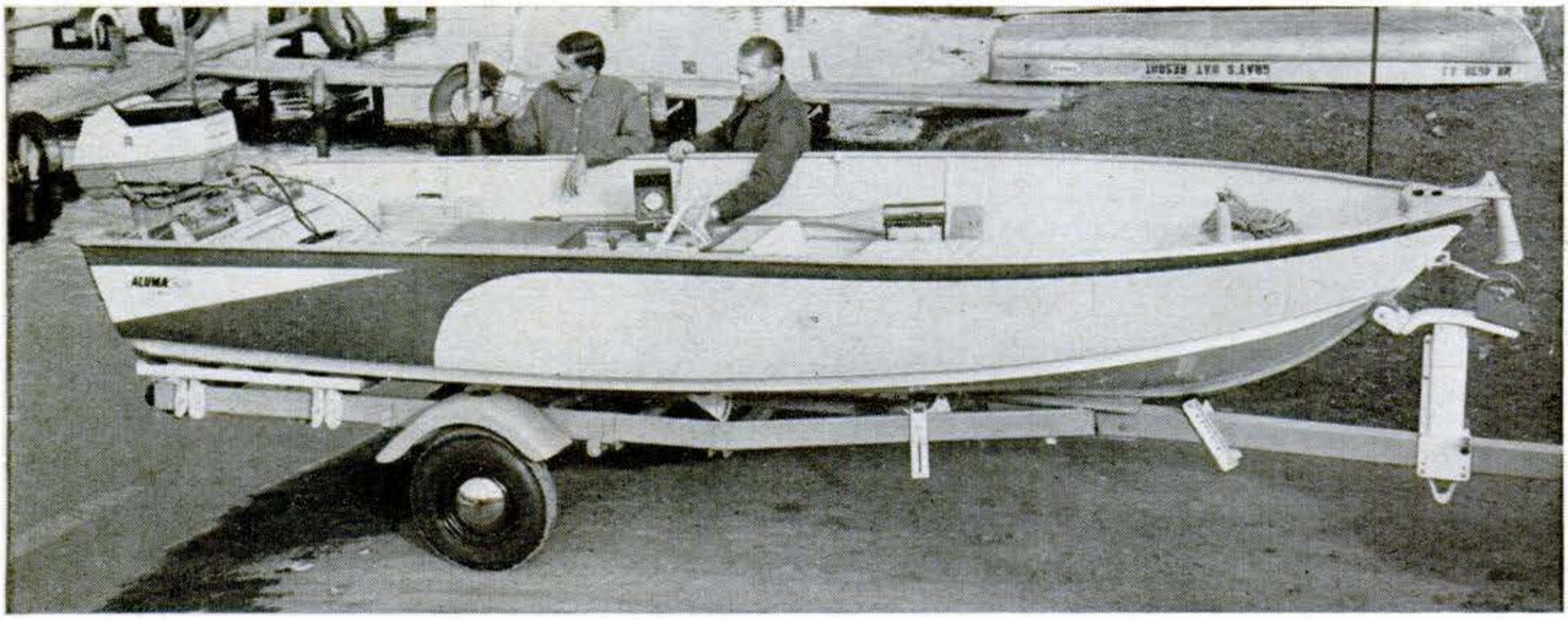

PHOTO BY SIFFORD AT LAKE MINNETONKA, MINN.

A 16-footer for the fisherman

Ideal for the angler, this Aluma Craft Yukon ($599) sports a 40-hp. Gale ($595), gets a lift on Aluma Craft's trailer ($188). For fishing, we've added Heddon tackle ($35), Umco tackle box ($26), Lowrance Fish Lo-K-Tor ($120), Constrom cooler ($27), Zenith's Royal Navigator ($100), American-LaFrance extinguisher ($20), Tapatco cushions ($4.50), Johnson transceiver ($110). All prices approximate.

OUTFITTING a boat—selecting the equipment you want to carry with you—is at least half the fun of boating. Basic safety gear, such as life jackets, is required by law—but the law covers only bare essentials and is not concerned with fun. Beyond the legal necessities are scores of gleaming extras, from impressive radio direction finders to simple picnic grills.

What extras? POPULAR SCIENCE decided to answer this by actually outfitting seven different boats for '63. Our selections are not intended to represent the only choices, and prices listed are approximate.

Bad outfitting advice is easy to come by. Oddly enough, some boat dealers make a determined effort to sell you too little equipment for your own good. "You don't need all that stuff," they say, hoping to make an easier sale.

Lists of legally required items are available from boat dealers, but these are often more lenient than is a storm-tossed sea. A case in point: Most regulations call for one life jacket per person. But

[*Text continued on page 122*]

Cruising on twin outboards

There are both speed and comfort in this 20-foot Thompson cruiser ($2,195) fitted with twin 65-hp. Mercury outboards ($895 each). Our traveling companions: Tapatco life jackets, buoyant cushions, and ski belts ($50 total), Apelco depth sounder ($130), Sony transceiver ($150), Ride-Guide push-pull cable steering ($90), Kilgore distress-signal kit ($20), Sea-Aid first-aid kit ($16), Kidde Co_2 fire extinguisher ($40), Fend-Aire floating fenders ($6 each), and Powerwinch ($100) for Gator's tandem-axle trailer ($623). Displayed on dash: Morse bilge pump ($28.50), Bendix radio-telephone ($470), Heath three-band RDF ($110), Heath tachometers (kits: $25 each), and Airguide compass ($22.50). On binnacle: Airguide speedometer ($15), clock ($25), barometer ($10).

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for 1963

PS BOATING

PHOTO BY TOOMEY
AT HOT SPRINGS, ARK.

A runabout for thrills

For skiing, picnicking, or general gallivanting, this 14-foot Traveler ($1,595) sets a brisk pace with a 40-hp. Johnson ($680). Besides life jackets and cushions, we've put aboard an Ansul dry-chemical extinguisher ($16), Danforth anchor ($10), Steermaster steering ($77), Sonar radio-telephone ($300), Edward Can gas tanks ($50), and Navionics instrument panel ($50).

A patio on pontoons

There's room for all aboard this 28-foot Kayot ($1,495) powered by a 28-hp. Scott ($465). For all-day fun, we've loaded her up with a Big Boy grill ($50), Supertherm cooler ($9), EEz-In folding table and chairs ($8 each), Sony TV ($230), Witmer diving board ($70), Stearns cushions ($6), Hailer Cub hailer ($48), BC Telecon transceiver ($30), and Ray-O-Vac lantern ($10).

PHOTO BY TONY LANE AT MANKATO, MINN.

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PHOTO BY TOOMEY
AT TOLEDO, OHIO

Day sailer for a family outing

You carry 166 square feet of dacron sails on Ray Greene's sleek 16-foot fiber-glass Rebel ($1,769 with sails). For all-around fun, we've included a three-hp. Evinrude ($165), Tapatco sleeping bag ($25), Red Head life jackets ($10), PAR hand bilge pump ($6.75), Radar-Lite lantern ($10.50), and Sperry TopSiders ($10) and foul-weather gear ($22). The Rebel has a retractable centerboard keel, can fly a spinnaker, even has room for a charcoal grill.

CONTINUED

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You supply the cargo...

Ford supplies the wagons (more than anybody else in the business)

Nobody else gives you this wide a choice (15 models! 4 sizes!). Nobody else makes 'em this carefree (routine service is needed only twice a year or every 6,000 miles!*). Here's the lively line-up:

Full-Size Fords—4 beautiful models including the distinguished Country Squire. Attic-size room ...a ride like velvet. Swing-Away steering wheel and deep-foam bucket seats, optional.

Middleweight Fairlanes – all-new for '63. They carry like the big ones, cost like some compacts.

Compact Falcons—they're big on gas economy, low on price. Over 7 ft. of flat, usable loadspace. Power-operated rear window standard in Falcon Squire.

Big Club Wagons – They handle twice the cargo of full-size wagons —yet cost less than some compacts! Can carry 8—can be equipped to sleep 4!

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PS OUTFITS 7 BOATS FOR '63

PHOTO BY TOOMEY AT WAUKEGAN, ILL.

For big water, a 30-footer

A big, go-anywhere boat, this Pacemaker Sedan cruiser ($10,000) is powered by twin 185-hp. engines. On extras, we've shot the works: White auto pilot ($585). Bendix depth sounder ($225), Pearce-Simpson radio-telephone ($520), Morse controls ($84.50 each engine) DF-O-Matic automatic RDF ($339), Zenith's nine-band Transoceanic receiver ($275), Ongaro fuel-consumption gauges ($55), Airguide engine-power meters ($16), Kelvin-White compass ($169), Half-Mile Ray spotlight ($115), distance-recording Sum-Log ($155), Judson engine synchronizer ($48.50), Airguide barometer ($15), and clock ($30). Electric stove, refrigerator, and heater are standard.

PHOTO BY DAN OWEN AT SKANEATELES LAKE, N.Y.

A roomy outdrive

From Chris-Craft's new Thompson division comes this 20-foot Luxury Transdrive Skiff ($2,090) powered by a 100-hp. Volvo outdrive. We've added a Casco extinguisher ($15), Raytheon radio-telephone ($336), Sperry RDF ($175), and Galley-Fridge refrigerator ($140).

CONTINUED

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since you can't depend on being able to reach all your jackets in an emergency, it's best to have extras.

Many regulations do not require distress signals for small boats. Yet small boats are the most likely to need them and are the least easy to spot when in trouble. Also, all fire extinguishers should be twins. If you use one up, it may be some time before you can have it recharged.

A weather-warning radio, once considered a luxury, is a must today for all boats, big or small, that operate on large lakes or on the ocean. Small portable radios capable of receiving long-wave government weather broadcasts cost very little.

Here's a rundown on the seven boats outfitted by POPULAR SCIENCE, along with some of the reasons behind the equipment we selected. (Our account follows the sequence of pictures starting on page 116.)

A 16-footer for the fisherman. The Yukon is big and brawny, built to take you to where the fish are and to bring you back. It has a round bilge, wide flared bow, and V hull. Full-length spray rails help make it a dry boat even in rough water. Foam flotation is built in.

We've powered this boat with a 40-hp. long-shaft Gale, a dependable, sensible motor, built to perform reliably and economically at all speeds. The sturdy Aluma Craft trailer is matched to the boat and has plenty of capacity for whatever gear a pair of fishermen can think of to tote along.

We've put a full complement of safety equipment aboard the Yukon. The dry-chemical American-LaFrance fire extinguisher is effective on any type of fire and easy to recharge after use. It is of the new, approved type—carbon tetrachloride extinguishers are no longer legal because of toxic fumes. Tapatco buoyant cushions give protection in case of a capsize.

Fishermen often overlook radios. But experience indicates that squalls come up suddenly, sneaking in to pounce on a small boat too far from shore to get in before the wind hits. That's why we've put a radio aboard our Yukon, the Zenith Model 790 Royal Navigator, one of the finest we've seen. This eight-transistor beauty receives weather-navigation stations on the 150-to-400-kc. band. It also tunes in the standard broadcast band and the marine band of 2 to 5 mc. Finally, there's a Lowrance Fish Lo-K-Tor, an electronic device that helps lead a fisherman right to the fish.

Cruising on twin outboards. There's lots to look at here. This 20-foot Thompson is a queen of the lapstrake fleet. It's built to last for many years of constant use and to be a safe boat in rough water. One of the best-known boats in the country, it gives a soft ride, is roomy, and performs like a well-mannered race horse. It has two bunks. There is room to install a marine toilet, and a galley unit unfolds into the cockpit.

We've equipped this cruiser with some of the finest power available—twin Mercury 65-hp. motors. These fast-moving, dependable power plants, new for '63, are controlled by Mercury's single-lever throttle and shift controls. The boat is equipped with Mercury's Ride-Guide mechanical steering. These three components—motors, controls, and steering—team up to form an extremely handy and dependable system.

The Gator trailer has tandem axles to provide plenty of load-carrying capacity for the big boat and its twin motors. A Powerwinch takes the back work out of hauling the heavy boat onto it. For life jackets, we've chosen Tapatco's yoke-type. This style is fast taking over the field, since it helps support a person's head above water. The fenders are Fend-Aire's one-piece molded vinyl, with extra-thick walls. They are hollow and float.

The fire extinguisher up in the front corner of the cockpit is a big Kidde Co_2, a comforting item to have aboard. It handles any type of fire, is approved, and has ample capacity for a big boat like the Thompson cruiser. The Kilgore distress-signaling kit is an important piece of equipment for any boatman. It includes red flares for night use and smoke signals for daylight.

The handy Sea-Aid first-aid kit is especially made for marine use. Open the cover and you find neat compartments containing a broad range of first-aid items. Tucked in the cover itself is a set of instructions on how to use them and how to give mouth resuscitation.

Apelco's depth sounder is one of the finest on the market, useful for warning the helmsman of shoals or for helping to find schools of fish. The Sony citizens-band transceiver is easy to handle, packs a lot of power into a small space.

Up on the dash, we've displayed a Morse high-capacity bilge pump, which will be installed in the bilge, out of sight. Next to it is a 65-watt Bendix radio-telephone.

[Continued on page 202]

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PS BOATING

The New Wonder Products for Boat Repairs

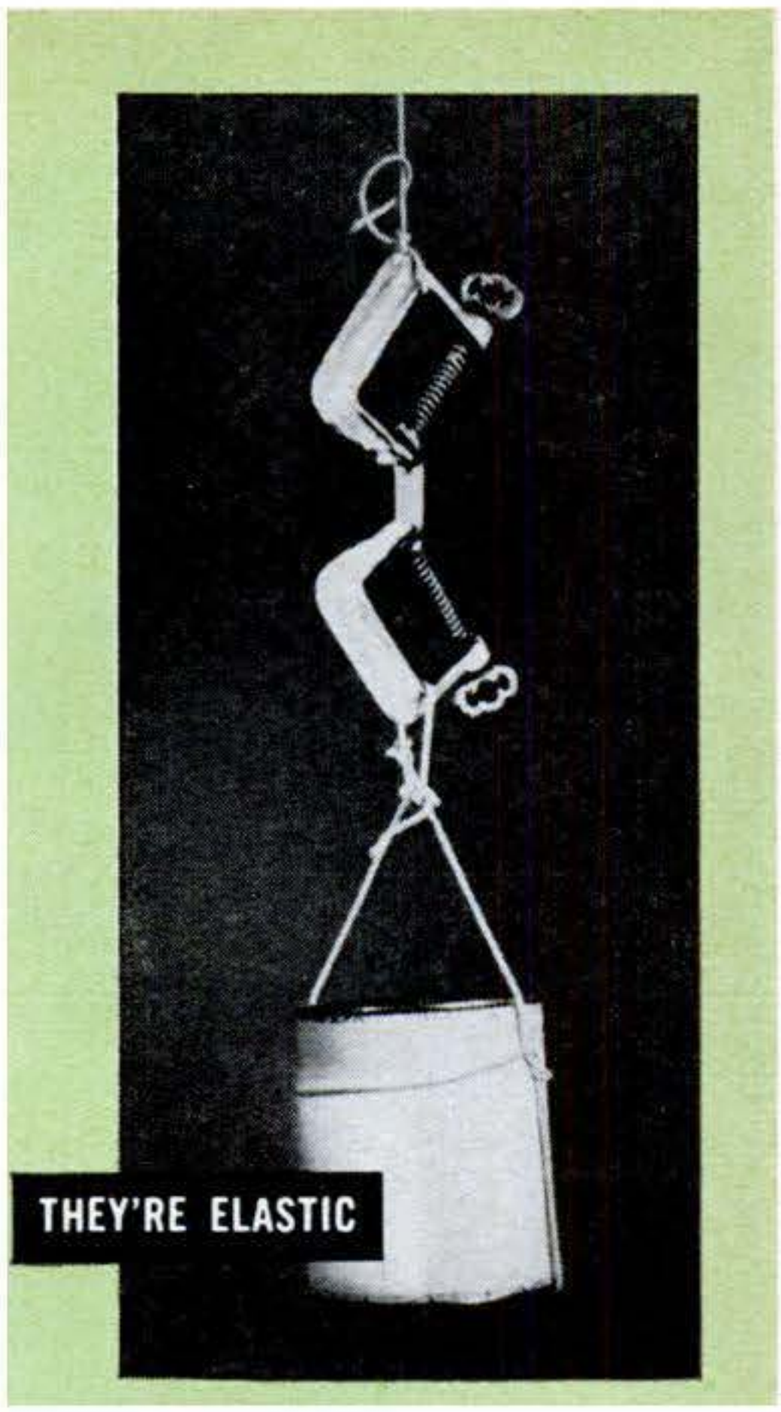
By George Daniels

YOU'LL find an increasing number of miracle workers among the cans, jars, and tubes now stocked by boat-supply dealers. By reducing the effort and expense of repairs, they make boating more fun. Some are so new you probably haven't heard of them. Others have come into marine use from other fields.

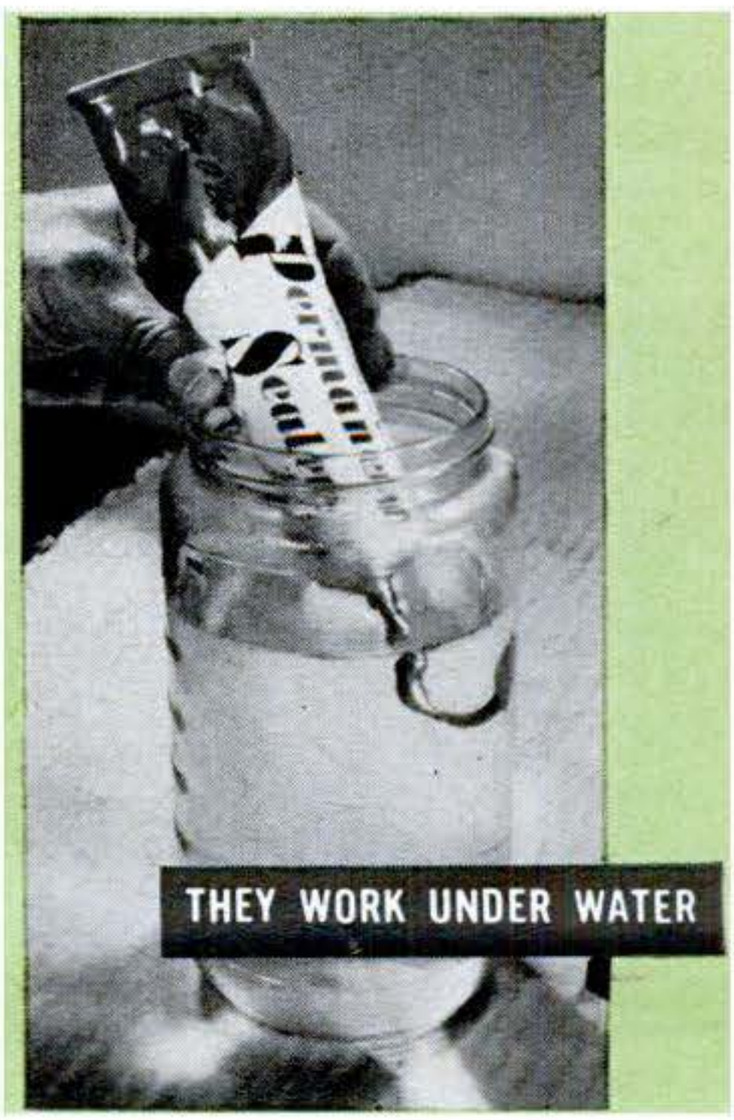
If your boat is new, you can brush on a finish this spring—and not touch it again until 1965. One refresher coat every two years will keep the boat gleaming. But what you use is not a paint. It's a synthetic hide so tough that it doesn't break even over smashed planking. It stretches.

If your boat's an oldie, there's a cure for every ailment in the book. A resin-chemical combination permeates the cells of rotted wood, making it tougher and harder than new. It undoes the damage of teredos by filling their labyrinths with harder-than-wood resin. Where loose fastenings are too old and corroded to pull off or redrive, resin formulas will lock them tight without tools.

New calkings spread like butter and turn into rubber. They stretch and squeeze as planks shrink and swell. They give in any direction as hulls twist in a rolling sea. They seal leaks that couldn't be stopped before. And they never let go. Tested to


THEY'RE ELASTIC

THEY'RE WATERPROOF


THEY WORK UNDER WATER

Home-style demonstrations of what three new boat-repair products will do are shown at right. Top, a strip of dried Vinylon (a brush-on boat skin) is gripped between clamps and supports a quart of paint. Plywood box with floating model has no metal fastenings or glue. It's held together by Seaprene. The Alum O Bond Permanent Sealer (right) can calk a seam under water.

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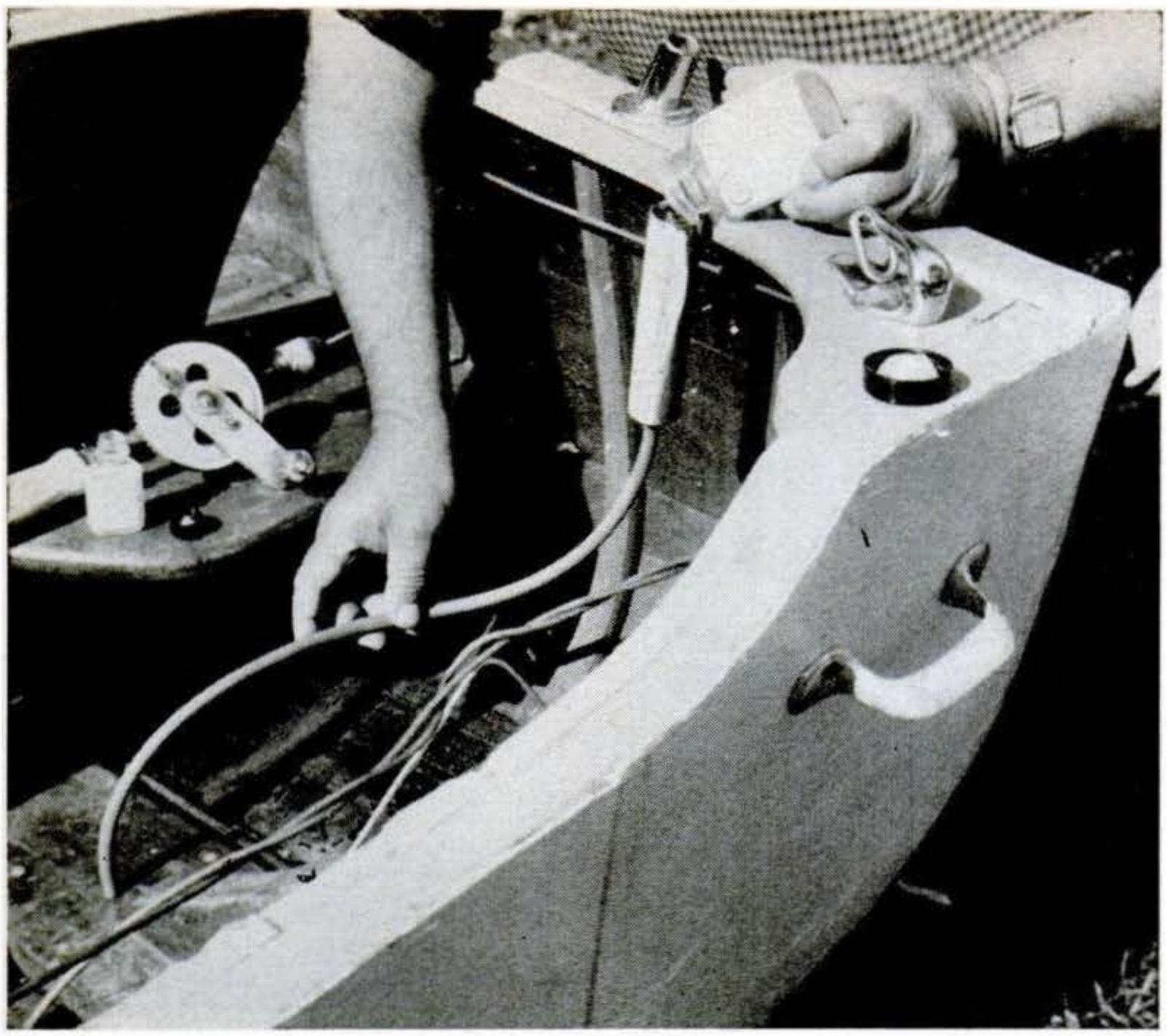
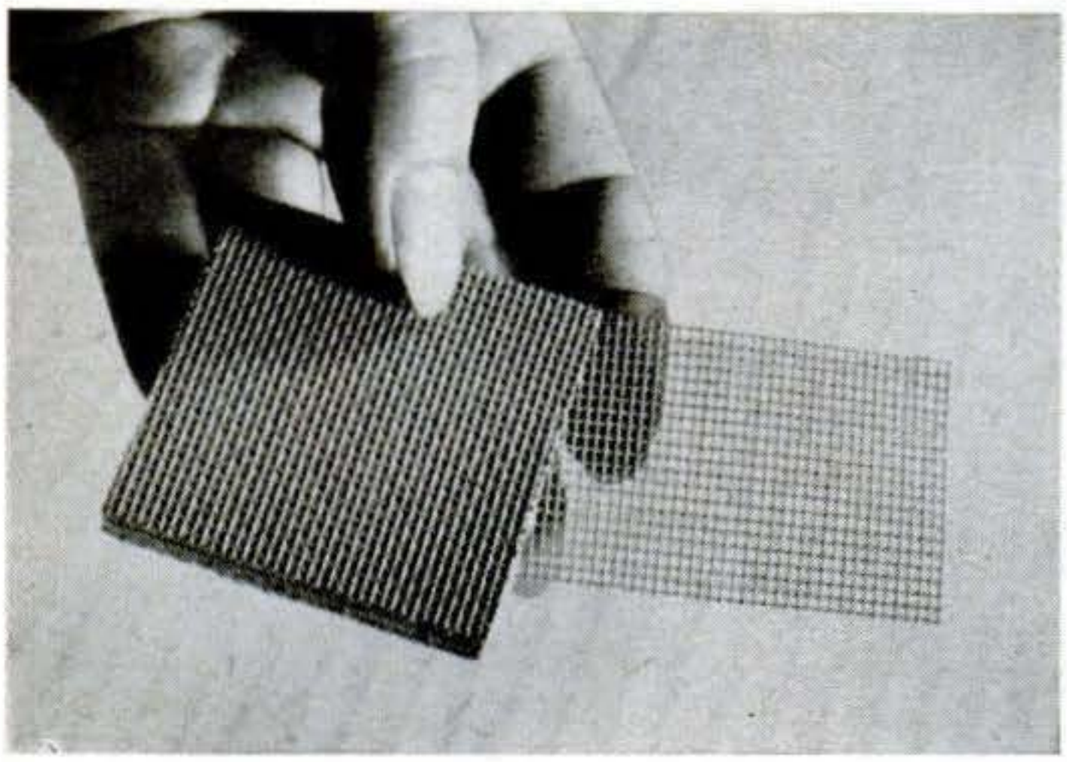


A shot in the arm for all rotted areas is offered by Calignum. This resin - chemical combination goes into every wood cell, making wood tougher and harder than new. At left, author feeds it into rotted keel section. Sketch shows it in use for hull repair.

destruction, they held fast while the wood broke.

There's a waterproof glue that sets in three minutes without clamps or pressure. Mend a broken timber by pouring the glue into the break. It's still holding the brigantine Yankee's topmast together after two trips around the world. It lets you fix anything—from a split boat hook to a cracked waterjacket or a broken muffler. But it didn't start as a boating item. It was invented by a University of Pennsylvania dentistry professor for filling teeth. It just happened to be one of the strongest of all waterproof adhesives.



A plastic mesh (Vinyl Weve) is used with new boat skin (Vinylon) to skidproof a deck. Coating bonds mesh to wood, as shown.

Now for specific details on other new products and the troubles they cure:

Leaks. The behavior of a leak is often your best clue to its cause. If a boat takes on water only after you come aboard, a seam just above the waterline may have been opened by shrinkage of sun-parched planks. This may happen in dark-colored boats during hot, dry spells; they absorb more heat. And it's likely in a skiff or rowboat with enough rocker (upsweep) to keep the bottom planking at bow and stern above water when she's empty during an idle week at the dock. Baked from above, planks shrink and seams open. Load the boat, and the open seams settle into the water. Old-timers often cured the trouble with lighter-colored paint. But new cures don't depend on color.

A leak after a rough-water jaunt probably stems from seam movement that worked out calking. Loose fastenings are often involved. But the slow, steady leak deep down in the hull has long been the sign of rot or borer damage. Look for the borers forward where antifouling is most often scraped off, giving them an entrance. Look for rot everywhere, but especially where ventilation is scant.

The trickiest leak to find is sometimes in an early-model fiber-glass hull or a fiber-glassed wood hull. Water enters through

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a small surface break or around a through-the-hull shaft or bolt, travels between layers, and dribbles in through some remote opening in the inner surface.

The classic case was in a line of early fiber-glass auxiliaries. Water entered around a propeller-shaft fitting at the stern, traveled half the length of the boat by capillary action in the fiber-glass mat, then entered the hull around the chain-plate bolts, higher than its entry point.

It took the manufacturer almost a year to track it down, minutes to cure it. Today's fiber-glass hulls are more thoroughly resin-saturated, eliminating such trouble. But it can still happen with fiber-glassed wood.

If it happens to your boat and you can't find where the water gets in, haul it with an ample load of bilge aboard and watch where the water comes out. If this doesn't work, suspect every underwater through-the-hull item from keel bolts to prop shaft and plumbing. What can't be conveniently removed for rebedding can be covered with polysulfide calking compound. If the job has to be rushed, one of the rubber-base calking cements can be used. They'll bond even to wet surfaces.

The centerboard leak, of course, is still with us. Its basic problem is this: Any leak should be stopped from the *outside*. But the outside of the centerboard trunk is actually the inside of the trunk, and nothing much bigger than a mouse can get in to do the job. The new synthetic hides provide a cure.

Rot. You can now forget about costly hull surgery. Instead of removing and replacing rotted parts, you simply harden them to greater than original strength with Calignum. This is a two-part formula of epoxy resin, special penetrants, and fungicides, pioneered by H. A. Calahan, Inc., of Mamaroneck, N. Y.

Rotted wood absorbs Calignum like a blotter. On thin sections you can brush it on sanded wood. On a heavy timber you bore ⅜″ holes about 3½″ apart and feed it in with a hose and funnel that come with the kit. You can restore vertical rotted areas by boring entrance holes slightly downward and tacking the funnel above them for an easy flow through the hose. You can tell when the wood is saturated because the surface becomes slick. Finish off the holes with wood plugs.

[*Continued on page 210*]

Some of the new boat-repair products

Alum O Bond:	A flexible, elastic calking you can apply under water. W. J. Ruscoe Co., 483 Kenmore Blvd., Akron 1.
Alroy 707:	No-cotton Thiokol calking for extreme expansion and contraction. No primer needed. Alroy Process, 333-Y Hudson St., NYC 13.
Alroy 711:	Marine epoxy coating for decks, roofs, hulls. Alroy, address above.
Calignum:	Makes rotted wood tougher than new. H. A. Calahan, Inc., 859 Mamaroneck, Mamaroneck, N.Y.
Interpoly Enamel:	A polyurethane coating that can be applied in adverse weather to raw wood or sound alkyd paint. International Paint Co., 21 West St., NYC 6.
Miracle Adhesive:	A rigid calking. Can be applied under water. Miracle Adhesive Sales, 250 Pettit Ave., Bellmore, N.Y.
Polypoxy Calking:	Use on wood, aluminum, or fiber-glass where extreme stretch and squeeze is needed. Pettit Paint Co., Belleville, N.J.
634 Polyurethane Calking Compound:	Use as calking, filler, or adhesive. Apply with putty knife or calking gun. Du Pont, Wilmington, Del.
Seaprene:	Forms synthetic rubber skin over entire hull. Calahan, address above.
3-Ton Adhesive:	For repairs on wood or metal. Sets in 3 minutes with hardener. Waterproof. Calahan, address above.
Vinylon:	For hull coating, topside or antifouling. F. C. Kenyon Co., P.O. Box 92, Whippany, N.J.
Vinyl Weve:	Mesh for use with Vinylon to make nonskid deck. Kenyon, address above.
Winterkote Red:	Keeps antifouling paint from drying out in storage. Flakes off in spring. Int. Paint Co., address above.

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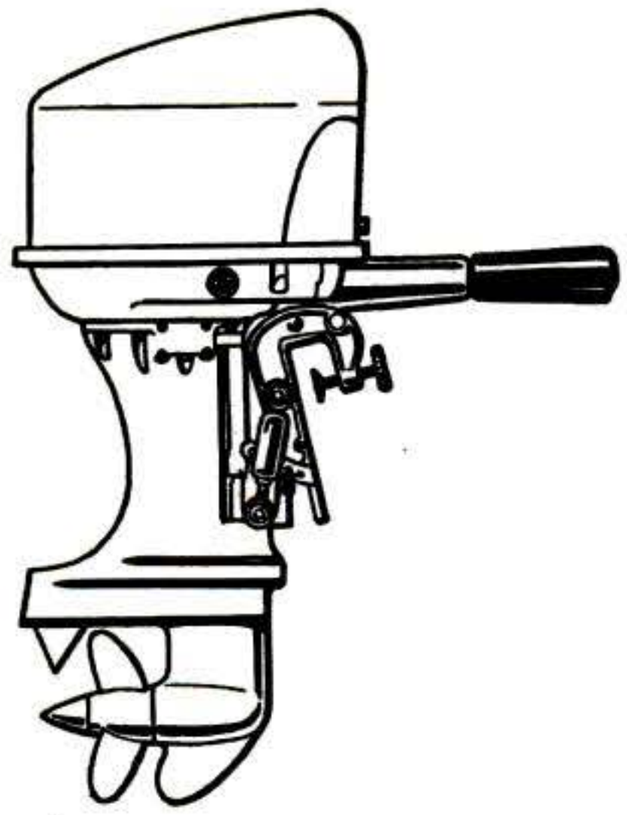

A Handy Guide to

TIME was when you could tell most of what there was to know about an outboard motor just by looking at it. But today's sophisticated motors have many of their talents hidden. To bring you that engineering information, PS has assembled this guide to the 1963 outboards. Most of these motors—except the very smallest—have gearboxes providing reverse, neutral, and forward. Most, too, can be equipped

MAKE AND MODEL	HORSEPOWER	NO. OF CYLINDERS	BORE & STROKE (inches)	DISPLACEMENT (cubic inches)	IGNITION (magneto or battery)	STARTING (manual or electric)	GEAR RATIO	PROPELLER DIAMETER & PITCH (inches)	SHAFT LENGTH (standard or long)	APPROX. WEIGHT (pounds)	BASIC PRICE (f.o.b.)
BUNDY											
300-M	20	2	2⅜ x 2.05	18.2	magneto	manual	14:25	9 x 9	both avail.	70	$ 425
500-M	30	2	2 13/16 x 2.44	30.3	magneto	manual	14:25	9½ x 12	both avail.	95	$ 495
500-E	30	2	2 13/16 x 2.44	30.3	magneto	electric	14:25	9½ x 12	both avail.	103	$ 595
CAL-JET MARINE											
Econojet 4	4	1	2 x 5⅛	5.1	magneto	manual	(water-jet drive)		standard	27	$ 169
ELGIN (Sears, Roebuck)											
Elgin 2	2	1	1¾ x 9/16	3.76	magneto	manual	14:21	6.5 x 4	standard	28	$ 105
Elgin 3.5	3½	1	2⅛ x 1¾	6.23	magneto	manual	13:21	7.5 x 6	standard	36	$ 119
Elgin 6	6	2	1 15/16 x 1 45/64	10	magneto	manual	17:25	6 x 7	standard	40	$ 239
Fisherman	7½	2	1 15/16 x 1 45/64	10	magneto	manual	17:25	6 x 7	standard	40	$ 239
Elgin 14	14.1	2	2¼ x 2 1/16	16.4	magneto	manual	13:21	7⅞ x 9.5	standard	70	$ 299
Elgin 28	28	2	2 51/64 x 2 7/16	29.97	either	either	15:23	9 x 10	standard	118	$ 399
Elgin 45	45	2	3⅛ x 2¾	42.18	battery	electric	14:23	10 x 10½	both avail.	152	$ 599
Elgin 75	75	3	3⅛ x 2¾	63.27	battery	electric	16:25	11.5 x 12	both avail.	179	$ 829
EVINRUDE											
Lightwin 3	3	2	1 9/16 x 1⅜	5.28	magneto	manual	17:28	6⅛ x 6¼	both avail.	34	$ 165
Fisherman 5½	5½	2	1 15/16 x 1½	8.84	magneto	manual	15:26	8 x 7¼	both avail.	56	$ 250
Sportwin 10	10	2	2⅜ x 1⅞	16.6	magneto	manual	13:23	8¼ x 8½	both avail.	69	$ 345
Fastwin 18	18	2	2½ x 2¼	22	magneto	either	12:21	9¼ x 11	both avail.	79	$ 385
Speeditwin 28	28	2	2⅞ x 2¾	35.7	magneto	either	12:21	10⅜ x 11½	both avail.	127	$ 465
Big Twin 40	40	2	3 3/16 x 2¾	43.9	magneto	either	12:21	(opt. choices)	both avail.	131	$ 570
Big Twin 40	40	2	3 3/16 x 2¾	43.9	magneto	electric	12:21	(opt. choices)	both avail.	147	$ 665
Lark 40	40	2	3 3/16 x 2¾	43.9	magneto	electric	12:21	(opt. choices)	both avail.	162	$ 775
Speedifour 75	75	4	3⅜ x 2½	89.5	magneto	electric	20:23	(opt. choices)	both avail.	222	$ 925
Starflite 75	75	4	3⅜ x 2½	89.5	battery	electric	20:23	(opt. choices)	both avail.	239	$1,065
GALE											
Buccaneer 3	3	1	2⅛ x 1½	5.32	magneto	manual	13:22	6⅞ x 6⅜	standard	29	$ 135
Buccaneer 5	5	2	1 15/16 x 1½	8.84	magneto	manual	15:26	8 x 7¼	both avail.	60	$ 225
Buccaneer 15	15	2	2⅜ x 2¼	19.94	magneto	manual	12:21	9 x 10	both avail.	81	$ 350
Buccaneer 25	25	2	2⅞ x 2¾	35.7	magneto	either	12:21	10⅜ x 11½	both avail.	120	$ 445
Buccaneer Sovereign	40	2	3 3/16 x 2¾	43.9	magneto	either	12:21	10⅜ x 13¼	both avail.	129	$ 500
V Sovereign	60	4	3 x 2½	70.7	magneto	electric	20:23	9½ x 10	both avail.	219	$ 835
HOMELITE											
Homelite 55	55	4	2.75 x 2.50	59.4	battery	electric	15:28	(opt. choices)	both avail.	227	$ 960
JOHNSON											
Sea Horse 3	3	2	1 9/16 x 1⅜	5.28	magneto	manual	17:28	6⅛ x 6¼	both avail.	34	$ 165
Sea Horse 5½	5½	2	1 15/16 x 1½	8.84	magneto	manual	15:26	8 x 7¼	both avail.	56	$ 250
Sea Horse 10	10	2	2⅜ x 1⅞	16.6	magneto	manual	13:23	8¼ x 8½	both avail.	69	$ 345
Sea Horse 18	18	2	2½ x 2¼	22	magneto	either	12:21	9¼ x 11	both avail.	79	$ 385
Super Sea Horse 28	28	2	2⅞ x 2¾	35.7	magneto	either	12:21	10⅜ x 11½	both avail.	127	$ 465
Super Sea Horse 40	40	2	3 3/16 x 2¾	43.9	magneto	either	12:21	10⅜ x 13¼	both avail.	131	$ 570
Super Sea Horse 40 Electramatic	Same as above but has remote electric gearshift and clutch									162	$ 775
Super Sea Horse V-75	75	4	3⅜ x 2½	89.5	magneto	electric	20:23	10¼ x 10	both avail.	222	$ 925
Super Sea Horse V-75 Electramatic	Same as above but has built-in AC generator and battery ignition									239	$1,065

NOTE: n.a.—information not available

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the '63 Outboards

with single-lever remote controls, push-pull mechanized steering, and generators or alternators. Some have these as standard equipment. The propellers listed are those normally supplied with the motor. If you wish to choose a different one, based on your intended use of the boat, be sure to talk over your decision with your boat and motor dealer. Most manufacturers can supply a wide range of propellers.

MAKE AND MODEL	HORSEPOWER	NO. OF CYLINDERS	BORE & STROKE (inches)	DISPLACEMENT (cubic inches)	IGNITION (magneto or battery)	STARTING (manual or electric)	GEAR RATIO	PROPELLER DIAMETER & PITCH (inches)	SHAFT LENGTH (standard or long)	APPROX. WEIGHT (pounds)	BASIC PRICE (f.o.b.)
MERCURY											
Merc 60	6	2	1¾ x 1½	7.2	magneto	manual	13:26	(opt. choices)	both avail.	49	$ 250
Merc 110	9.8	2	2 x 1¾	11	magneto	manual	13:26	(opt. choices)	both avail.	55	$ 345
Merc 200	20	2	2 9/16 x 2⅛	22	magneto	manual	13:24	(opt. choices)	both avail.	n.a.	$ 415
Merc 350	35	2	2⅞ x 2 3/10	30	magneto	either	13:24	(opt. choices)	both avail.	n.a.	$ 510
Merc 500	50	4	2 9/16 x 2⅛	44	magneto	either	14:23	(opt. choices)	both avail.	n.a.	$ 610
Merc 650	65	4	2⅞ x 2 3/10	60	magneto	electric	14:28	(opt. choices)	both avail.	n.a.	$ 895
Merc 850	85	6	2⅞ x 2 3/10	90	battery	electric	14:28	(opt. choices)	both avail.	n.a.	$1,070
Merc 1000	100	6	2⅞ x 2 3/10	90	battery	electric	14:28	(opt. choices)	both avail.	n.a.	$1,225
PERKINS											
Perkins 4.5	4½	2	2 x 1½	9.42	magneto	manual	13:21	7½ x 5½	both avail.	40	$ 250
Perkins 6.5	6½	2	2 x 1½	9.42	magneto	manual	13:21	8 x 6½	both avail.	60	$ 299
Perkins 18	18	2	2½ x 2 1/32	19.94	magneto	either	12:21	9 x 11	both avail.	90	$ 415
Perkins 30 Deluxe	30	2	3 1/16 x 2⅞	42.35	magneto	electric	13:21	10 x 12	both avail.	130	$ 640
Perkins 40	40	2	3⅛ x 2⅞	44.10	magneto	either	13:21	10 x 13	both avail.	135	$ 715
SCOTT											
Scotty	3.5	1	2⅛ x 1¾	6.23	magneto	manual	13:21	7½ x 6	standard	36	$ 136
Fishing Scott	7.5	2	1 15/16 x 1 45/64	10	magneto	manual	17:25	6 x 7	standard	39	$ 265
Fleet Scott	14.1	2	2¼ x 2 1/16	16.4	magneto	manual	13:21	8¼ x 8½	standard	68	$ 345
Sport Scott	28	2	2 51/64 x 2 7/16	29.97	magneto	manual	15:23	9 x 10	both avail.	102	$ 465
Sport Scott Electric	28	2	2 51/64 x 2 7/16	29.97	battery	electric	15:23	9 x 10	both avail.	122	$ 545
Royal Scott Manual	45	2	3⅛ x 2¾	42.18	magneto	manual	14:23	(opt. choices)	both avail.	138	$ 565
Royal Scott Electric	45	2	3⅛ x 2¾	42.18	battery	electric	14:23	(opt. choices)	both avail.	142	$ 695
Flying Scott Electric	75.2	3	3⅛ x 2¾	63.27	battery	electric	16:25	(opt. choices)	both avail.	183	$ 975
SEA KING (Montgomery Ward)											
Sea King 3	3	1	2⅛ x 1½	5.32	magneto	manual	13:22	6⅜ x 6⅞	standard	32	$ 118
Sea King 5	5	2	1 15/16 x 1½	8.84	magneto	manual	15:26	8 x 7¼	standard	67	$ 199
Sea King 15	15	2	2⅜ x 2¼	19.94	magneto	manual	12:21	9 x 10	standard	88	$ 320
Sea King 25	25	2	2⅞ x 2¾	35.7	magneto	manual	12:21	10⅜ x 11½	standard	119½	$ 415
Sea King 40	40	2	3 3/16 x 2¾	43.9	magneto	electric	12:21	10⅜ x 13¼	both avail.	133	$ 560
Sea King 60	60	4	3 x 2½	70.7	magneto	electric	20:23	9½ x 10	both avail.	205	$ 795
WEST BEND											
Shrimp 3½	3½	1	2 1/16 x 1 9/16	5.18	magneto	manual	14:21	7.5 x 4.5	standard	28	$ 150
Shark 7½	7½	2	2⅛ x 1 11/16	11.97	magneto	manual	14:21	7.5 x 7.5	standard	47	$ 250
Silver Shark 120	12	2	2⅜ x 2	17.72	magneto	manual	14:21	8.5 x 8	both avail.	68	$ 345
Silver Shark 200	20	2	2 7/16 x 2.140	19.96	magneto	manual	14:21	8.5 x 8.5	both avail.	74	$ 410
Golden Shark 300	30	2	3 x 2.667	31.71	magneto	either	13:21	10⅜ x 11½	both avail.	116	$ 475
Golden Shark 450	45	2	3⅛ x 2.750	42.18	magneto	electric	13:21	10⅜ x 12½	both avail.	134	$ 625
Tiger Shark 800	80	4	3⅛ x 2.750	84.36	battery	electric	16:25	12⅛ x 13	long	242	$1,030

NOTE: n.a. information not available

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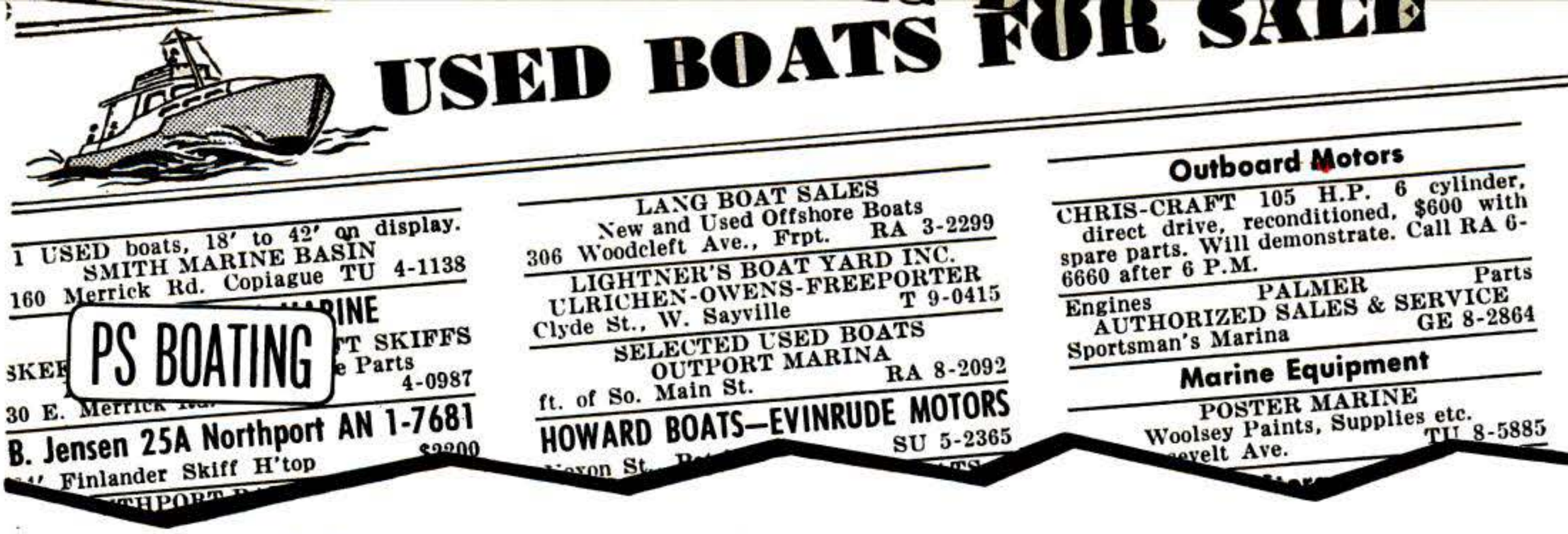


How to be a sharp trader when you're

Buying a Used Boat

WHETHER a used boat is a good buy or a clunker depends on what you do *before* you buy it. In many ways, judging a used boat is even trickier than judging a used car. Often, you can't just hop in and drive it around the block—it may be stored miles from water or you may be shopping in the middle of winter. And a boat's most serious defects, such as rot or a weakened frame, are the least apparent to the casual eye.

You'll have to be prepared for some extra-sharp-eyed snooping. Don't shy away, however, if you spot a few easy-to-fix troubles. They may actually benefit you by lowering the sale price. An outboard runabout with a fist-size hole in the bottom sold last season at the near junk price of $45. She was repaired in an afternoon, and now is worth roughly 10 times her cost.

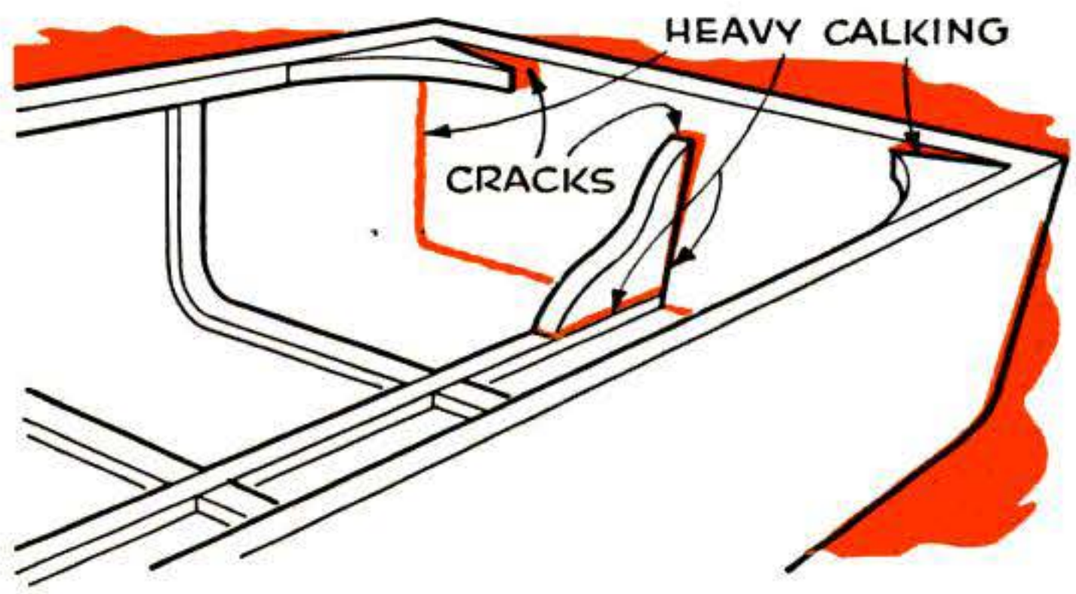
To start sizing up a boat, keep these basic points in mind. A boat stored under shelter will be in better shape than one left in the open. If it was used in fresh water, it's likely to have less metal corrosion than a salt-water boat. And it's unlikely to have borer damage; only a few very large bodies of fresh water support borers. Hence, some dealers automatically price a fresh-water boat about 15 percent higher than a salt-water one.

On the other hand, here's where a salt-water boat may be a bargain. A well anti-fouled salt-water hull is usually borer-free, yet may sell for less than a fresh-water hull. And if it was trailered rather than moored, it has missed most of the added corrosion.

A salt-water boat may also be less likely to have dry rot—at least below the waterline. Here, the salt, acting as a disinfectant, tends to kill off the bacteria that cause dry rot (actually wet rot). Above the waterline, however, a salt-water boat is just as subject to rot as a hull used in fresh water.

From here on, common sense and basic check-up methods can guide you. Here's what to look for:

The transom is your first check point on an outboard hull, especially if the boat might have been overpowered. (Even a medium-power outboard puts a levering force of close to 500 pounds on the transom.)



If the transom knees on wood or plywood hulls have pulled loose even slightly, look further. If there are signs of extra calking where planking and transom meet, there have been leaks. If calking cotton has been driven from inside the hull (amateurs often do this), it has probably made matters worse by prying the planking away from the transom edge. Chances are you'll have to remove the transom and re-bed it. This is a big job that should price the boat well below average for its class.

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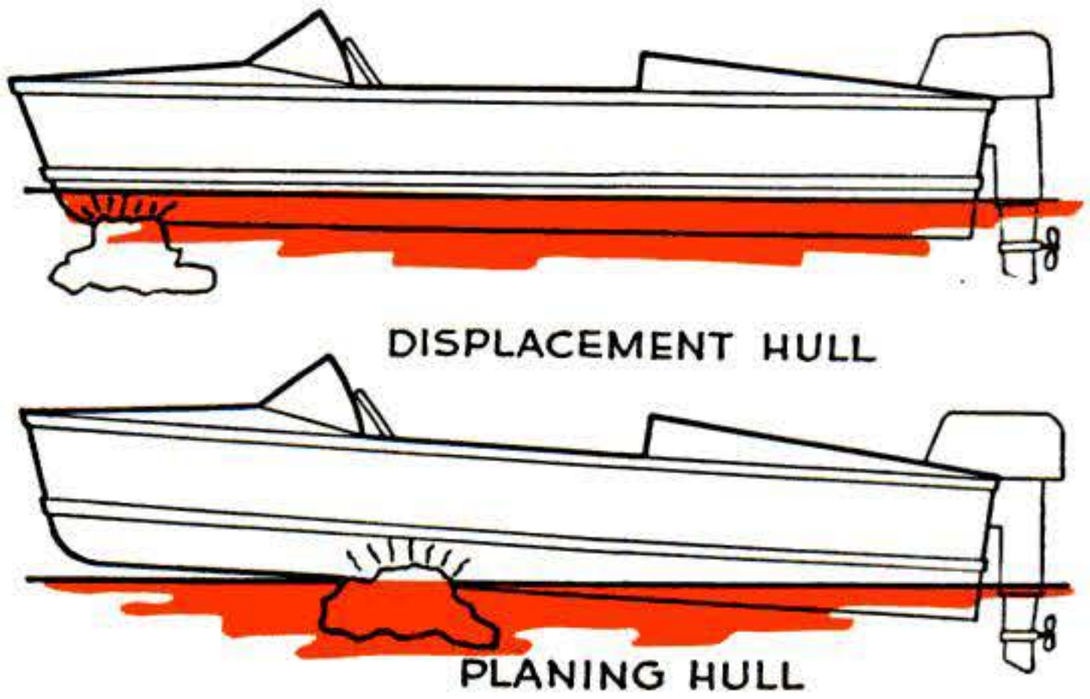
Fiber-glass hulls often have plywood transoms capped with metal that sometimes traps moisture beneath it. Take a good look here for signs of delamination. If minor, it can be cured by running resorcinol or similar glue into the opened edges. Also check the outside where hull and transom meet for signs of stress cracking in the fiber-glass. If they're pronounced, they must be treated like a break and reinforced from inside. This isn't too likely, but it's worth looking for.

Don't mistake surface crazing for cracking. The fine-lined crazing that develops in some fiber-glass hulls with age can be cured by sanding and refinishing. If the crazing is localized, however, it may be the result of an impact. Take a look inside at the same location for more serious effects. On moderate damage, repairs are easy. But if you can't do the job yourself, get an estimate on what it will cost before you buy.

Aluminum hulls of recent manufacture are generally of suitable alloys. (Some early postwar models were not.) If the hull shows deep corrosive pitting, avoid it. Don't worry about a few dents in an otherwise sound hull. They can be hammered out with a rubber mallet.

Loose rivets are your only other worry. If they are few in number, you can easily tighten them with a hammer and fender block. If they are numerous, don't buy. They may be a sign of shoddy assembly work, and still more may loosen.

Repaired hull damage shows up best inside the hull. Look for it forward in displacement hulls that ride bow-low in the



water. Fast planing hulls that ride bow-high generally show damage in the after area.

CONTINUED

Check these points before you buy

☐ **How was it stored?** Indoors is best. If outdoors, hull should be turned upside down and blocked up. Right-side-up storage may invite hull-freezing damage.

☐ **Where was it used?** Fresh-water boats are free of salt-water corrosion, rarely have any borer damage.

☐ **Was it trailered or moored?** A trailered hull suffers less corrosion and borer damage, especially in salt water. But be sure it wasn't stored on the trailer. This gives poor support, may warp the hull.

☐ **Is the transom sprung?** If it has pulled away, it will be a source of hard-to-stop leaks and may indicate that the boat was severely overpowered.

☐ **Has it been in a collision?** Look inside for telltale hull patches. Small, sound patches are okay; but avoid a hull that shows extensive impact damage.

☐ **Are there signs of rot?** Look for dark, soft areas. Badly peeling paint may not be a serious fault in itself, but be sure the wood underneath is sound. Check for borer damage along the keel. Avoid aluminum hulls that are badly pitted.

☐ **Are fittings loose?** This is often a sign that a boat is old or has had rough use. Check the fastenings for corrosion and the wood around them for splitting or softening. Traces of old canvas under fittings and trim indicate the hull was designed for a canvas covering and was never properly re-covered.

☐ **Is there a "hook" in the hull?** Look for a slight downcurve near the stern. This is built into some early boats or may result from improper storage. Either way, it's not desirable.

☐ **How was the motor used?** Look for telltale clues. Water skis indicate hard use, fishing tackle usually light use. Check the prop for nicks—signs of engine-jarring impacts. Try ease of starting and, if possible, an actual test run.

☐ **How old are the sails?** On a sailboat, sails can cost almost as much as the boat itself. If cotton, they're likely to be at least five years old, will need replacement soon. If nylon with cotton thread, they may have to be resewn. On the hull, apply the same checks as for any boat.

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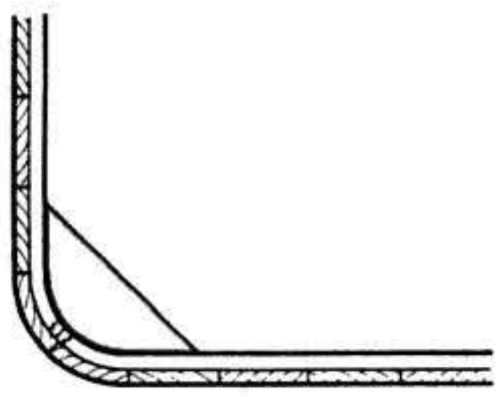
A patched hull need not scare you off if the patch is soundly applied. A good job will show inside, but not outside. The original hole is trimmed so a filler block can be fitted into it and calked smooth. The filler is then backed up on the inside with a larger block that extends several inches beyond the hole all around. Screws should go into the patch from the *outside* of the hull, not the inside.

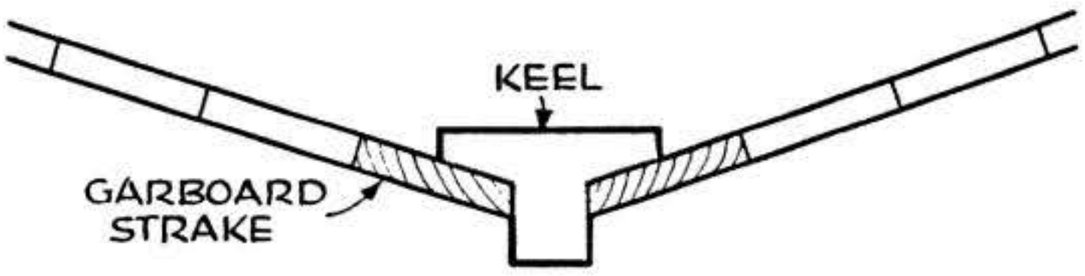
Don't rule out a boat because of a few cracked ribs, either. The cracks, usually at the curve of the bilge, can be reinforced with glue blocks. This is a lot easier than replacing a rib, and the result is often stronger.

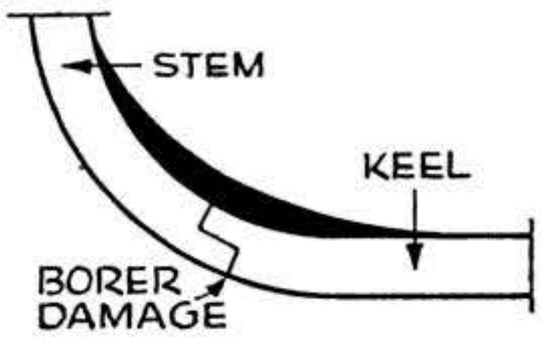


Patches on aluminum hulls are usually on the outside, with rivets passing through to the inside. These must be well bedded in a sealer, such as Alumalastic or Pliobond, between them and the hull.

While you're scanning a hull's interior, lift out any removable floor sections. Wood rot is likely to occur in the still, damp air under them. Test with an awl or ice pick. Stick it into sound wood first to get the feel. Then try areas that look darkened or soft. If the point sinks noticeably deeper into the wood, you have rot.

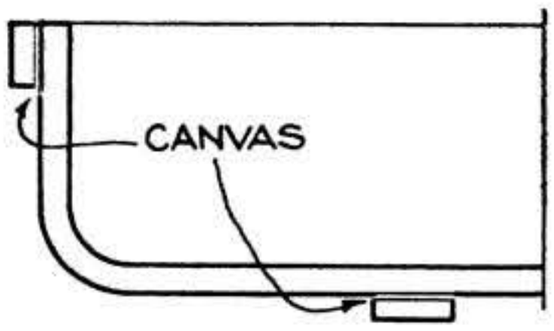
The most vulnerable planks for rot in a wood hull are the garboard strakes (next to the keel). They remain wet longest after a boat has been removed from the water. The most likely spots to find borer damage are in the joints around the keel, especially where keel and stem meet.





Small areas of rot and borer damage can be hardened with newly developed chemicals. Large areas can either be hardened or removed and replaced. Either way, it's expensive, so the sale price should be low.

On thin-planked hulls (around ½″), look for traces of canvas under the keel and rub strips, especially if there are also signs of heavy calking. Many boats of this type are designed for a canvas covering. When the original canvas goes bad, they're stripped to the bare wood. Owners who can't recover them try to calk the seams instead, but leaks invariably persist.



When the price is low enough, these hulls are ideal subjects for re-covering with canvas, dynel, or fiber-glass. But price your covering materials before you buy the boat. The job isn't cheap, and other leak-proofing methods won't do.

These and light strip-planked hulls may show a slight downcurve or "hook" in the bottom line at the stern. Some boats get it from improper storage cradling. Others (usually old-timers) are designed with a hook to add stern lift and prevent a nose-high running trim.

The built-in hook steals a little speed, but the boat may still be a good performer. It's a tricky subject at best, as some boats develop a hook only under power when an oversize outboard actually bends the bottom with its thrust. Out of the water, without the stress, the hook vanishes.

Boat and motor combinations. If you're buying a used hull with a motor that looks too big for it, check with the boat's manufacturer for the recommended power. (The manufacturer's specs are a more reliable guide than the various power charts that must cover many hull types.) Many first-time skippers overpower their boats and

[Continued on page 228]

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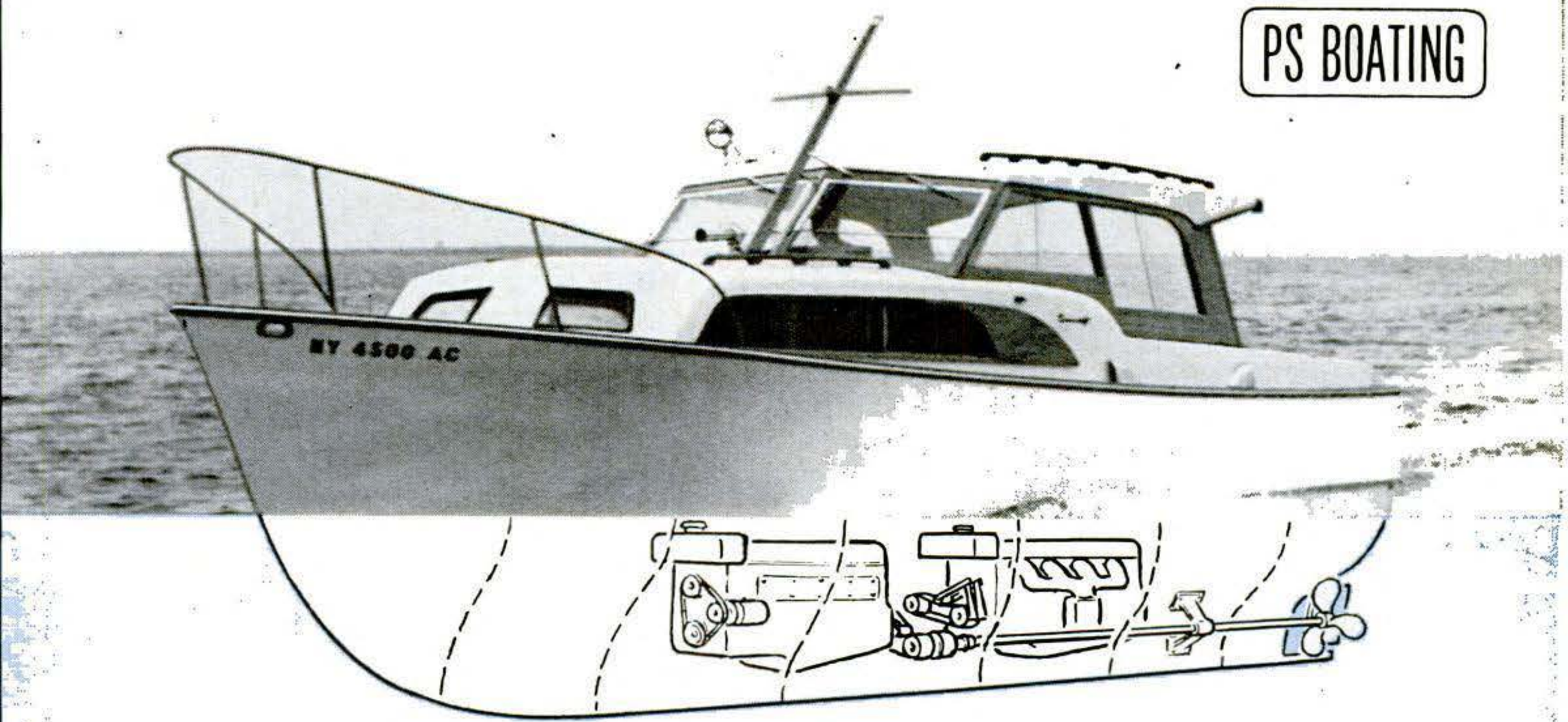
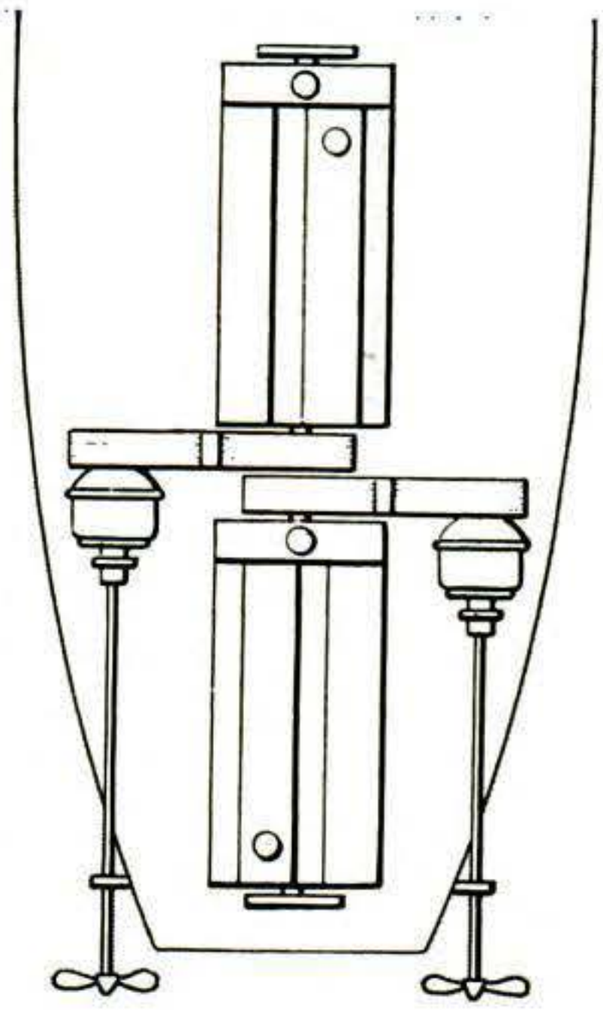


Tandem-Engined Boat —Built for Big Water



HERE'S a new way to install twin engines—mount 'em in tandem. That's how this new 34-foot Sumnercraft cruiser packs its twin 100-horsepower Ford diesels. Ingenious V-belt drives transmit power to the twin screws, as shown above. Belts run from the engines to Warner reversing gears, which have a 1½:1 reduction. Broad idlers facilitate quick removal of the heavy-duty belts.

Big advantages of this tandem-style twin installation—contrasted with normal side-by-side placement—are two: a much lower center of gravity and a lower overall silhouette of the boat. The Sumnercraft cruiser (built in Amityville, N. Y., by the Sumner Boat Co.) has a distinctive ballast keel, similar to a sailboat's, that permits mounting the in-line engines at a point so low they are almost level with the propellers, eliminating the need for sharply angled conventional prop shafts. The drawing above shows how the forward engine faces toward the rear to shorten its prop shaft and make it almost equal in length to the rear engine's shaft.

The tremendous stability of the lowered engines combines with a full-rounded transom, watertight bulkheads, and plastic-foam flotation to make the Sumnercraft an exceedingly able boat for ocean cruising. Her hull is of Compoglas—an inner layer of edge-glued planking with fiber-glass layers both inside and out.

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Answers to
A Beginner's Questions

What'll it cost? What kind of boat? What size? Should you trailer a

ARE you puzzled about how to join in the fun of the thousands of persons who enjoy boating each year? Many people are. But you needn't be. Here are answers to some of the most-asked questions to cross the boating editor's bow:

Q ***I've heard boating is really for the well-heeled. Is this true?***

A No. There are nearly 7½ million boats in the country. There aren't *that* many rich men. You can get into boating for any figure from $50 to $50,000.

Q ***What boat can I get for $50?***

A Lots. A good secondhand canoe—perhaps the most useful and romantic pleasure craft in the world. A secondhand rowboat. Maybe even a motor to go along. I got my first outboard for just $25; it worked fine. Or you can pick up secondhand small boats of several other different types, for instance a good sailing dinghy.

Q ***What's the cost of a few typical family-boating rigs?***

A New, you can buy a 15-footer, a 28- to 40-hp. motor, and a trailer for anywhere from $1,000 to $1,500. A good 16-footer will cost under $2,000.

For about $5,000 you can get a fancy runabout in the 18-to-22-foot class, with inboard, twin outboard, or inboard-outboard power. You're really driving quite a boat. And for $8,000-$10,000, you can graduate into a 25- to 30-foot cruiser.

Q ***If these are so much fun, why are there so many used boats for sale?***

A A boatman is often a fickle-hearted creature. Though he may love his present boat dearly, he secretly has his eye on one three feet longer.

Q ***What's the best "first boat"?***

A The most popular small boat in your area. This answer will pull a sackful of objections—and with some justification. No one can say what boat another person will like. But there are several good reasons for taking a look at the type of boat that's really popular in your home waters. First of all, that boat has undoubtedly proven itself.

Other reasons: There will be good buys available. Dealers will be used to servicing and repairing them. And you'll have friends available who can help you learn the skills of handling that particular boat.

Q ***My youngsters want a boat for water skiing. My wife wants one that's safe. I want one that looks good and that will make some speed, yet be easily maintained. Are we all talking about the same boat?***

A Sure. Just get any one of several well-built runabouts.

Q ***I see pictures of people painting and scraping. The captions say this is fun, but it doesn't look like fun to me. How much of that would I have to do?***

A Perhaps none. Certainly very little. A wood boat looks best if it's painted each season. If the boat is not in the water continuously, however, but is trailed to water and kept on the trailer much of the summer, it probably won't need to be painted

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About Boating

By Jim Roe

boat or keep it in dock? An expert offers solutions to these problems

but once every second or third year. Or you can get a fiber-glass boat that will need painting only after many years, or an aluminum one that need never be painted.

Q ***What's your opinion? Shall I try to leave my outboard runabout in one place all summer, or shall I keep it on a trailer.***

A Trail it. There are lots of interesting boating places within a day or two's drive from most any one's home. Sample them all.

Q ***Is boating more fun than most other hobbies?***

A Yes, and to prove it, consider this: Boating and many other hobbies go together. Photography, swimming, radio and electronics, motors, travel—boating gives you a chance to enjoy all of these at the same time. Better yet, you can enjoy them *as a family*. It's hard to find sports and hobbies that genuinely interest people of different age groups. Boating does.

Q ***I'm going to buy an outboard boat. Should I have two motors or one?***

A *You'll* have to decide this one. Personally, I like two. Modern outboards seldom malfunction, but any piece of machinery is subject to damage. I like to have a motor left to come home on.

Q ***What's the most popular-size boat?***

A A 15- or 16-foot outboard.

Q ***I don't know much about boating,***

[*Continued on page 222*]

What'll we name her?

So you have your boat. The next thing to do, as every boatman knows, is to paint her name proudly on the transom or the side.

All boats are girls. Even a giant ore boat with the imposing name "Benjamin F. Fairless" is always referred to as a "she."

So by all odds the favorite method of naming a pleasure boat is to name her after the object of your affection. Four out of five boats bear such names as "Jane," "Flossie," "Mary," "Myrt," or the slightly suggestive "Katy-did."

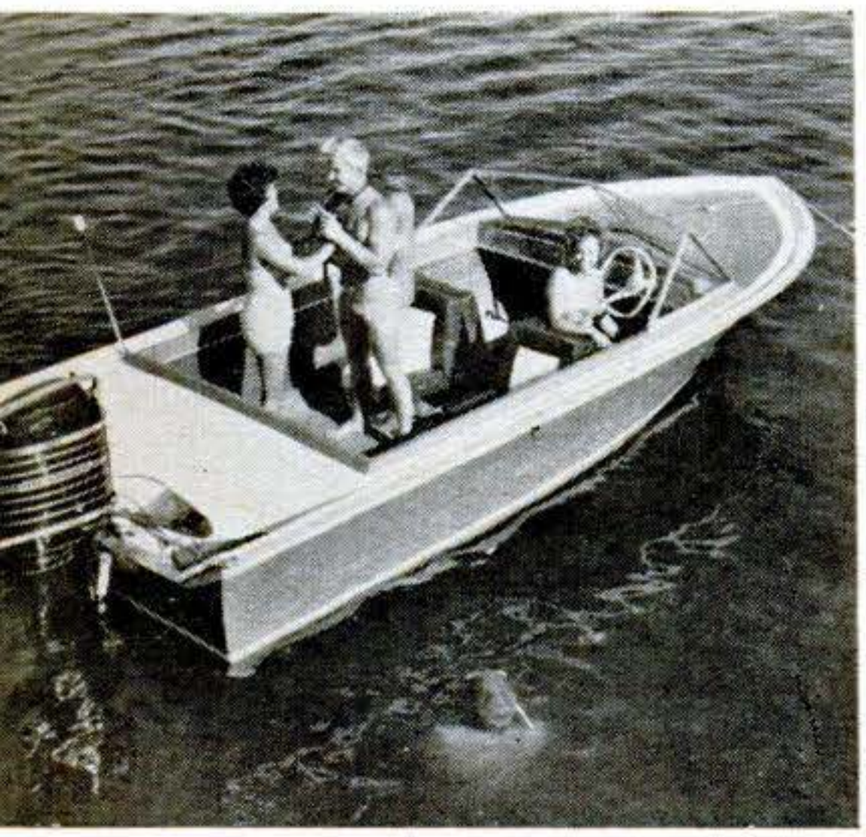
Some men, made of sterner stuff, resolutely think up non-girl names for their boats. If you do this, the sky and your imagination are the limit. Some samples:

- Hopeful: "Off the Rocks"
- Beginner: "First Luff"
- Romantic: "Outward Bound"
- Triumphant: "We-Dun-It"
- Classic: "Utopia"
- Guilty: "Truant"
- Nonsensical: "Heave II"
- Rueful (price reminder on a 50-footer): "Martha's Mink"

Corny, you'll say. We laugh at 'em, too. But we hear a snicker over the water as *we* pass by. Our boat's name? "Roeboat IV"!

9. LUHRS 32′ CRUISER

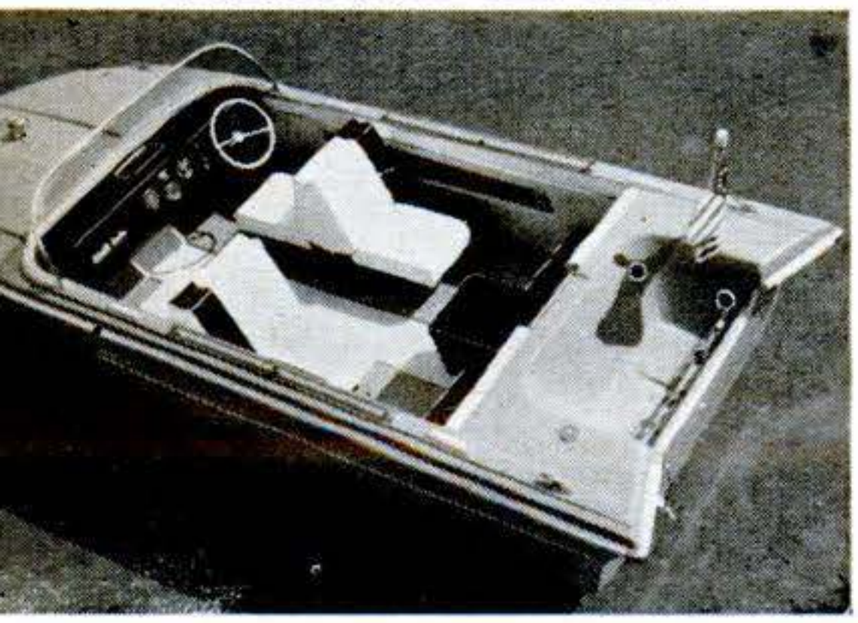
10. SEA RAY 808



11. CHRIS-CRAFT CORSAIR

12. DURATECH GALAXY

13. SHELL LAKE CARAVELLE



WHAT'S NEW FOR BOATING IN '63

[Continued from page 115]

boat can be had with a long-shaft transom, or can be fitted with any of several factory-installed stern drives. You can get it in a Standard or Custom version. Even the Standard has many extras, and of course the Custom has "extra" extras. Besides these, this small cruiser can be fitted with stove, sink, head, water tank, and mechanical steering.

Builder Henry Luhrs puts out about as much boat for the money as anyone I know. You can buy a really big boat—a 32-footer—for under $8,500. This boat (photo 9) comes complete with a 215-hp. Gray, flying bridge, equipped galley, sleeping accommodations for six, instruments, tanks, and many other extras. These are good, honest lapstrake boats, built of ¾″ solid-mahogany planking, copper-riveted and screwed to oak ribs. They have self-bailing cockpits, forward hatches, easy-maintenance fiber-glass covering on the forward deck and cabin roof. Owners like them. One day last fall I was climbing in and out of partly finished boats at the Luhrs plant and had a chance to visit with boatmen who had brought their boats back to the plant for service. They like everything about them, from their seaworthiness to their roominess.

If everyone in your family wants a windshield all his own, try the Sea Ray 808 (photo 10). One of a family of fiber-glass runabouts, this 17½-foot model has two windshields—one at the lower level forward, and one higher amidships. This 1,100-pound boat can be powered with outboards or with stern drives. As an outboard model, it comes with a 20″ (long-shaft) transom, lists at $1,725.

Chris-Craft continues to make news for 1963. Long the country's largest builder of medium- and large-size power-boats, they now show every evidence of being interested in supplying boatmen with any type of boat. Just a year or so ago they entered the wood lapstrake outboard and smaller inboard-boat field through the purchase of Thompson of Cortland, N. Y. Then, in the fall of 1962, a handsome sailboat was announced—Chris-Craft's first sailboat. Still more recently, they've declared their intention of producing a new fiber-glass line of outboard boats, under the name of Corsair. As a beginning, these will come in 15- and 17-foot lengths (the 17-footer can be powered by an inboard-outboard Transdrive). The reinforced hull construction of Chris-Craft's Corsair line will have a sandwich-type bottom. It will be fiber-glass, with a wood core permanently molded in place, packed solid with plastic flotation between inner and outer hulls. Longitudinal speed stabilizers will offer control at high speed and less drag. Shown in photo 11 is the new Corsair Sunlounger—a 17-footer with lots of cockpit space and foam berths for two.

Aluminum decks with bonded vinyl material have been an interesting feature of Duratech boats for several years. Applied with heat and pressure, the vinyl material is said to be permanent, abrasion-resistant, and color-fast. It's on the deck of the Galaxy model shown in photo 12. The Galaxy is an 18-foot aluminum runabout, designed to give

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lots of room. It has storage in a bow locker, under the front seat, and in the right backrest. For 1963, this boat can be obtained for use with outboards or Volvo, Interceptor, or MerCruiser stern drives. It has Styrofoam flotation and self-bailing well, sells at $1,249.

A trend in many fiber-glass boats this year is the installation of versatile seats that can be used back-to-back or lowered to form a sunbathing or napping couch. The 18-foot Shell Lake Caravelle (photo 13) calls this Strato Lounge Seating, and even though the chances are you won't get far enough above sea level to be in the stratosphere, it certainly looks mighty comfortable for lounging. Besides this, the rear seat has a tricky fold-out console that can serve as a snack bar or what-do-you-need-to-stow?

For both safety and rigidity, the boat has a double-bottom construction with end-grain balsa filler and foamed-in flotation under the deck. Unlike many boats, it comes with a complete instrument panel that includes speedometer, clock, tachometer, electric gas gauge, dash light, cigarette lighter, light switches, horn. It also has a built-in gas tank, storage shelves, and ski racks. Total cost is $1,595.

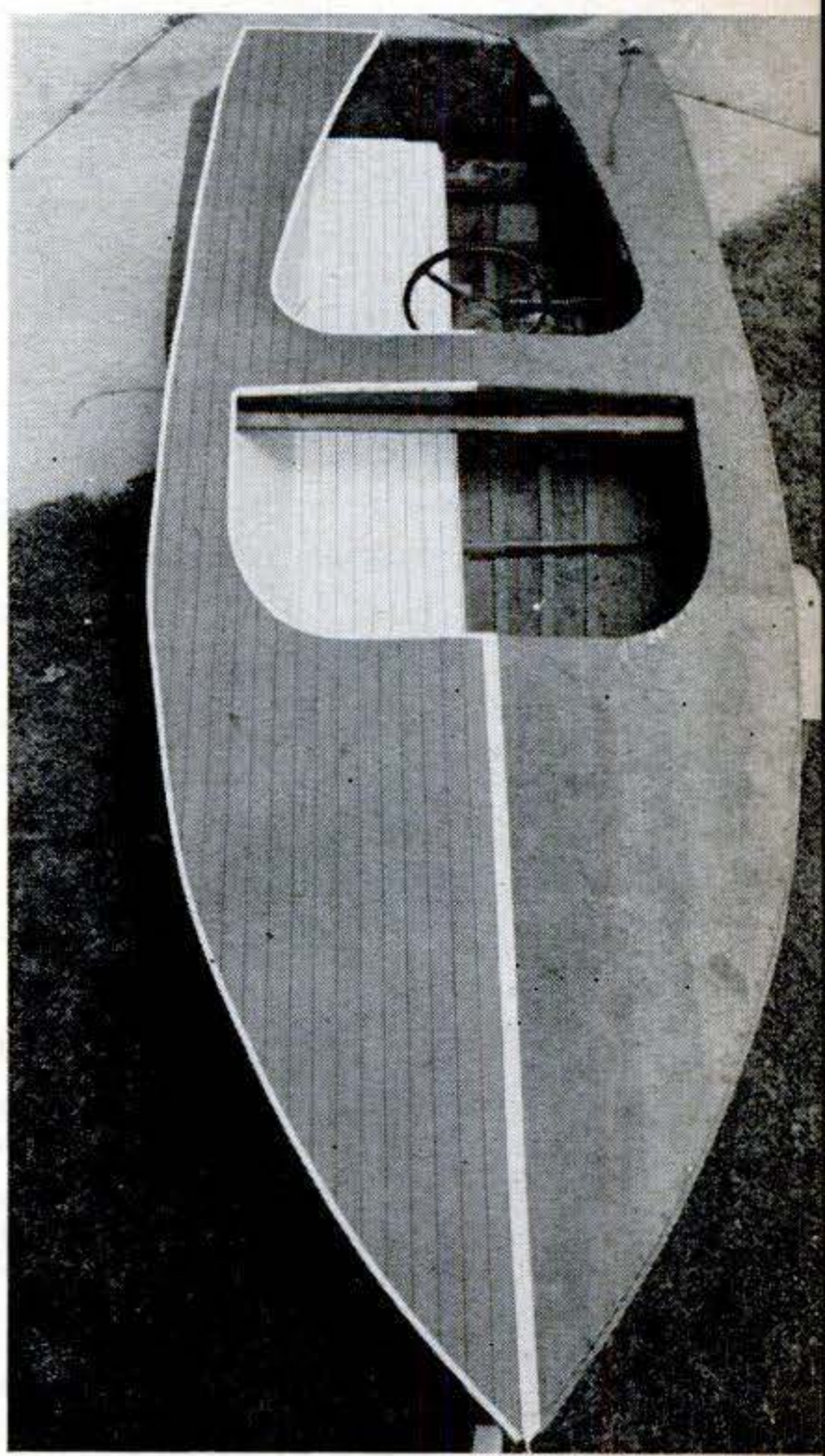
From time to time, the auto makers try to make their creations look like boats or airplanes. Conversely, automotive features occasionally show up in boats. An example of this is in the Jetflite by Glastron (photo 14). This 13½-foot runabout has bucket seats with a console between.

Lots of new products are now available to help keep your present boat Bristol-fashion, or to rehabilitate a hull that has fallen on dark days. Photo 15 gives a dramatic illustration of a face lift with Nautolex. This is a vinyl marine fabric that has been installed here on the deck, flooring, and side panels of the starboard side of a weather-beaten boat, with the port side still showing how the neglected creature looked before chemistry and ingenuity took over. There are many handy chemicals and materials available to the boatman these days—and discussed in this issue of PS (page 123).

A new bow hatch is offered by Lone Star engineers this year. It's a handy feature that allows a person to walk forward from the cockpit to the bow. A sliding windshield center section makes it easy to use. Shown in photo 16, it's installed on Lone Star's 16-foot aluminum Medallion. This model, in common with all Lone Star models for 1963, features hydroformed aluminum construction. This is done with a 1,000-ton-capacity press, which forms the metal into structural shapes said to be impossible with ordinary fabrication methods. This results in contoured aluminum sections, eliminating much of the seaming formerly needed. The Medallion model has a lapstrake-style hull, with lift rails for easy planing.

Finally, one important trend you'll note this year is the increasing use of mechanical steering in outboards—solid-core push-pull cables in place of flexible tiller cables. The reason: the growing size of outboard and outdrive power plants. The more horses you're driving, the more leverage you need to swing them from side to side.

14. GLASTRON JETFLITE



15. NAUTOLEX TO THE RESCUE

16. LONE STAR MEDALLION

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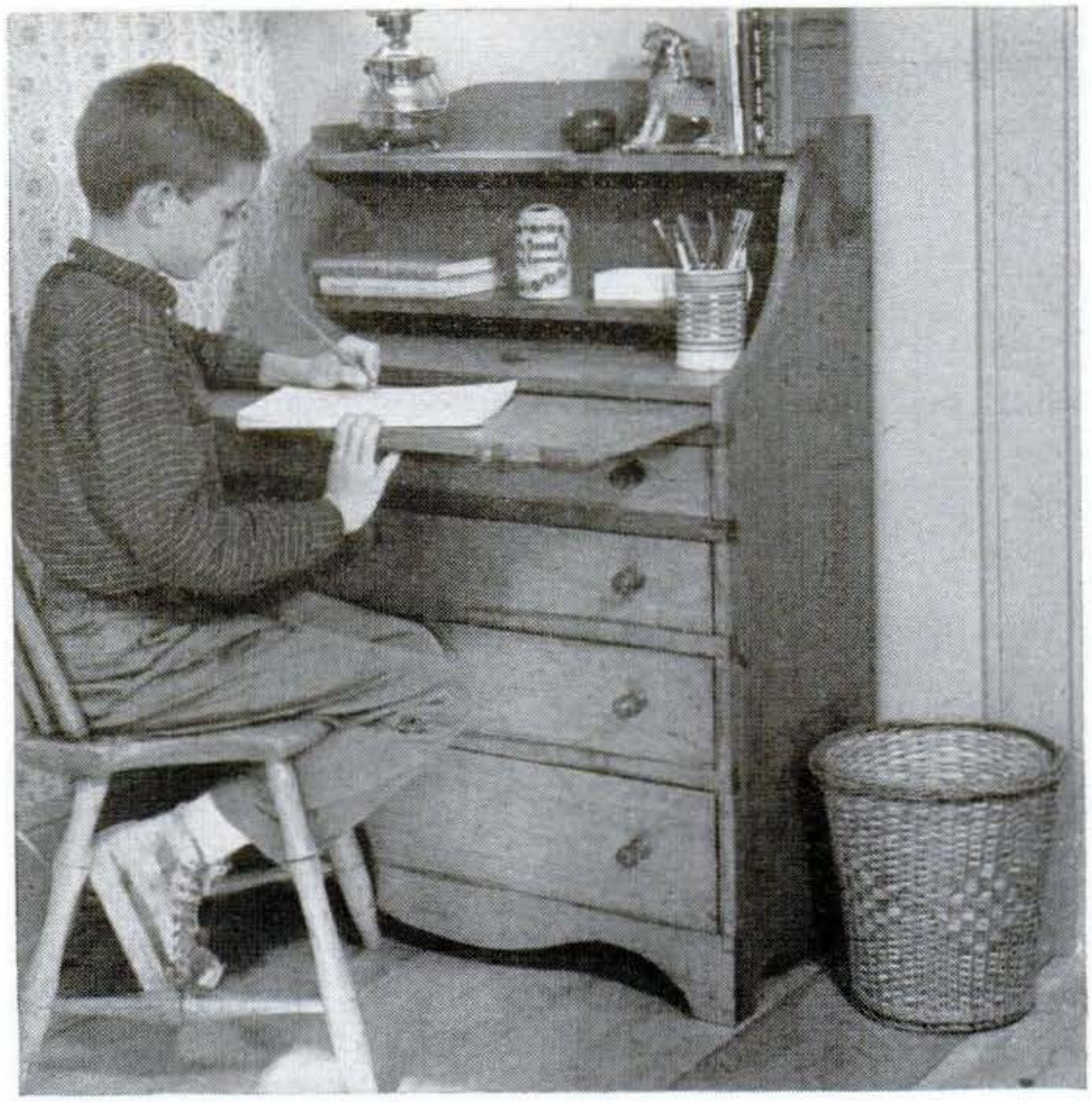
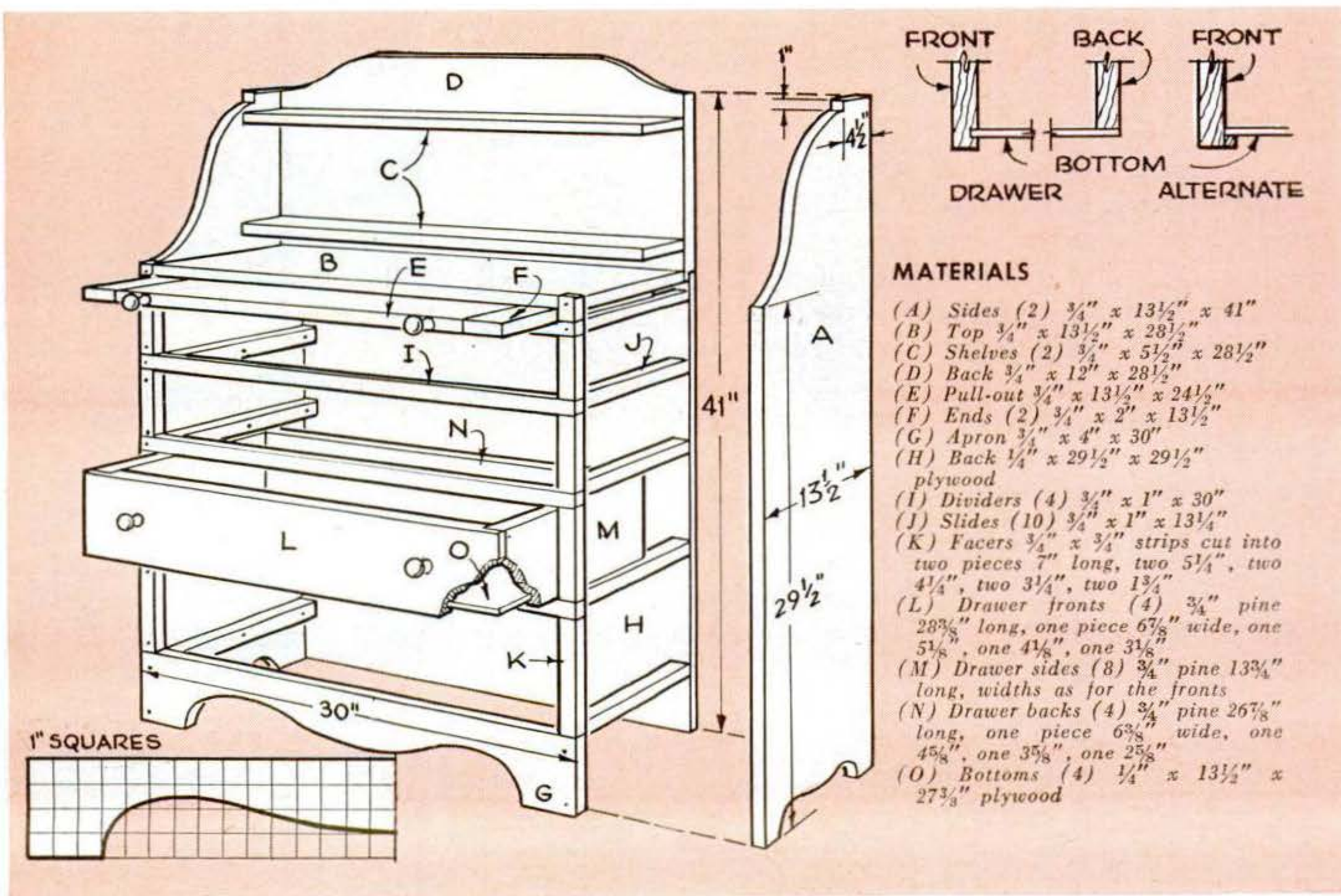
Chest-Desk for a Child



Styled after an early New England piece, this little chest-desk will do double duty in a child's room. Of white pine, it has a wipe-on finish to give the wood a mellow, satiny appearance.

It features cabinetmaking tricks that make construction remarkably simple. A neat one is the way the drawer dividers across the front are "let in" to the front edge of the sides. You don't have to cut notches. Instead, you nail and glue ¾"-by-¾" strips to the front edges, spacing to create notches.

Joints are mostly butts, held together by glue and screws or nails. Begin assembly by nailing the drawer slides to the inside faces of the 41"-long sides. It's easy to make what appear to be hand-cut nails for use where the heads will show. Start with ordinary common nails. Put the edge of a nail on any anvil-like surface and hit it with a hammer. Rotate it 90 degrees and hit again. Round off the head slightly with a hammer.



MATERIALS

(A) Sides (2) ¾" x 13½" x 41"
(B) Top ¾" x 13½" x 28½"
(C) Shelves (2) ¾" x 5½" x 28½"
(D) Back ¾" x 12" x 28½"
(E) Pull-out ¾" x 13½" x 24½"
(F) Ends (2) ¾" x 2" x 13½"
(G) Apron ¾" x 4" x 30"
(H) Back ¼" x 29½" x 29½" plywood
(I) Dividers (4) ¾" x 1" x 30"
(J) Slides (10) ¾" x 1" x 13¼"
(K) Facers ¾" x ¾" strips cut into two pieces 7" long, two 5¼", two 4¼", two 3¼", two 1¾"
(L) Drawer fronts (4) ¾" pine 28⅜" long, one piece 6⅞" wide, one 5⅛", one 4⅛", one 3⅛"
(M) Drawer sides (8) ¾" pine 13¾" long, widths as for the fronts
(N) Drawer backs (4) ¾" pine 26⅞" long, one piece 6⅜" wide, one 4⅝", one 3⅝", one 2⅝"
(O) Bottoms (4) ¼" x 13½" x 27⅜" plywood

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Fastest Way to Build a Model Plane

Shape it from Styrofoam and you save many hours of work

By Roy L. Clough

PROGRESS gets blamed for a lot of things, but sometimes it can make a complicated job simple. A model plane built of Styrofoam is a good example.

It once took hours to build a good flying model, and after it was built you had little assurance it would hold its shape and remain flyable. Using Styrofoam, you can put together a model in record time, and performance is sure to be good. There's little chance of poor alignment or warpage later on.

The model is light and rugged. If it hits something at full speed, say a guy wire, a chunk could be knocked out of the wing. But this is no problem; you simply cut out the damaged section, paste in a new piece of Styrofoam, and sand it down to the original contour.

You can get Styrofoam for your model in most hardware stores or florist shops. It's quite easy to work the material: Shape it with a sharp razor blade; bring it down to the final contours with coarse sandpaper. Take light strokes—heavy ones will gouge out chunks. Smooth down the wings with a finer sandpaper. You won't be able to get them glassy smooth, but don't worry about it. A textured wing of this type will lift as well (in this narrow-chord, low-speed range) as will gleaming doped surfaces.

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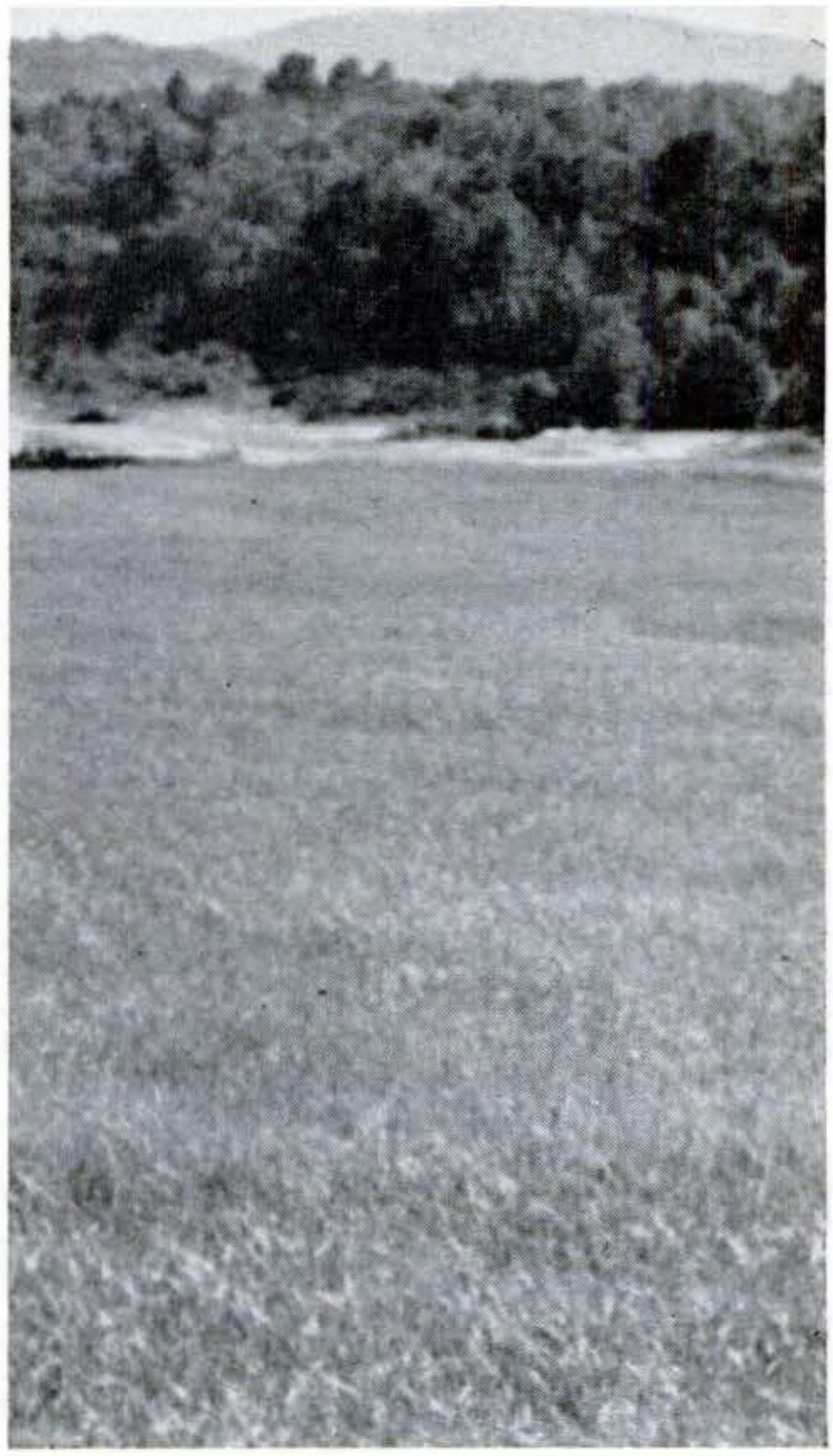

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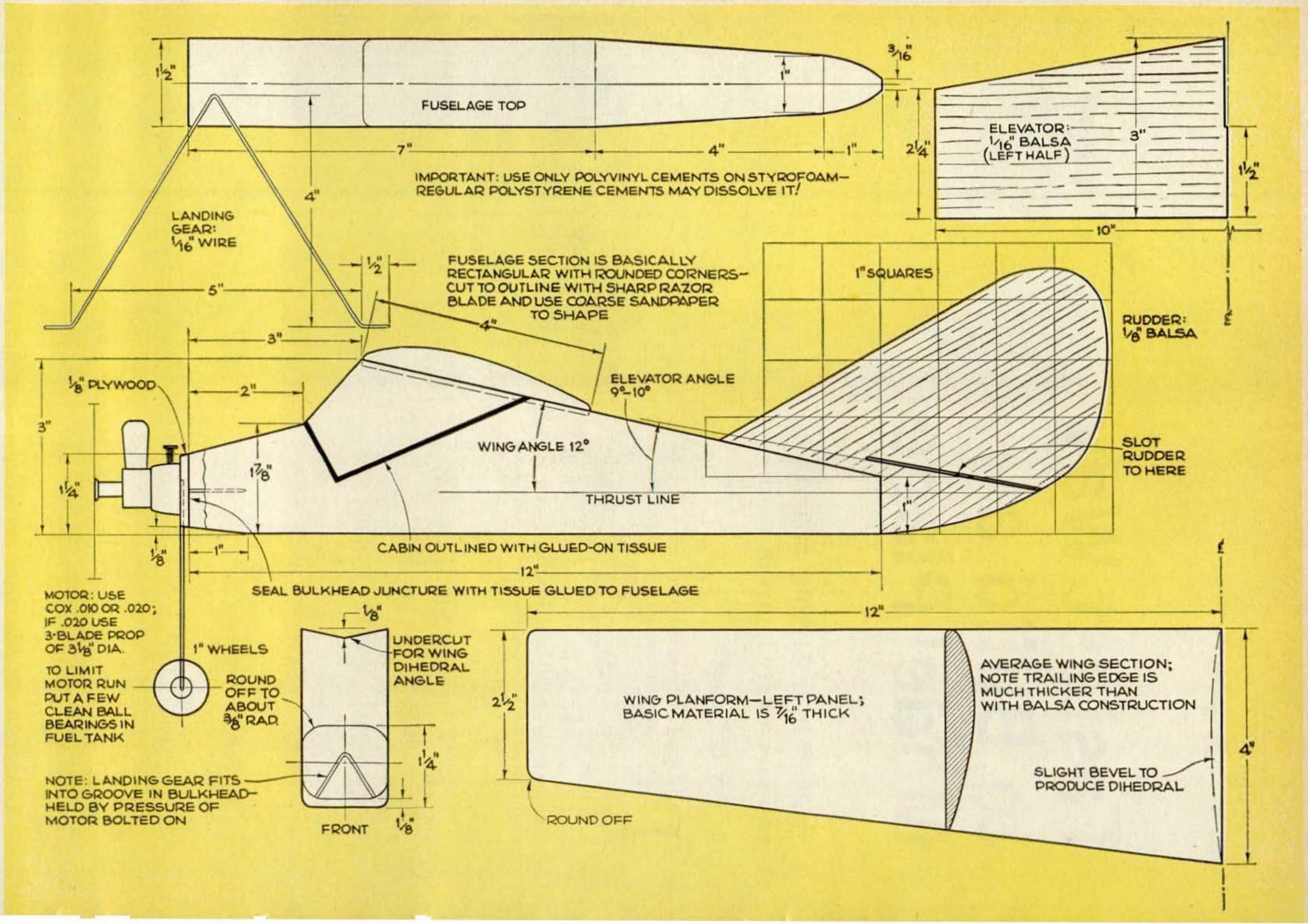

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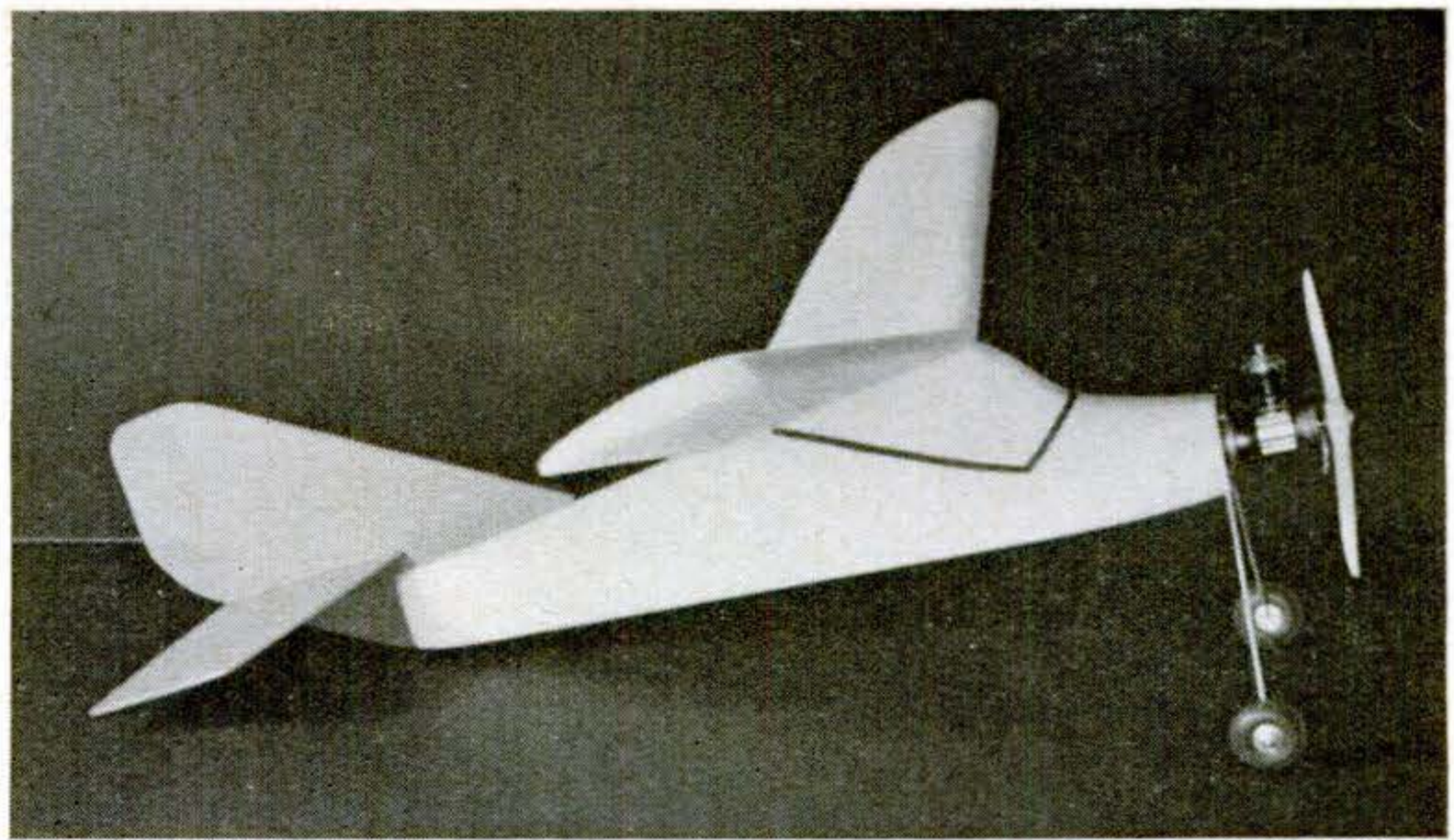
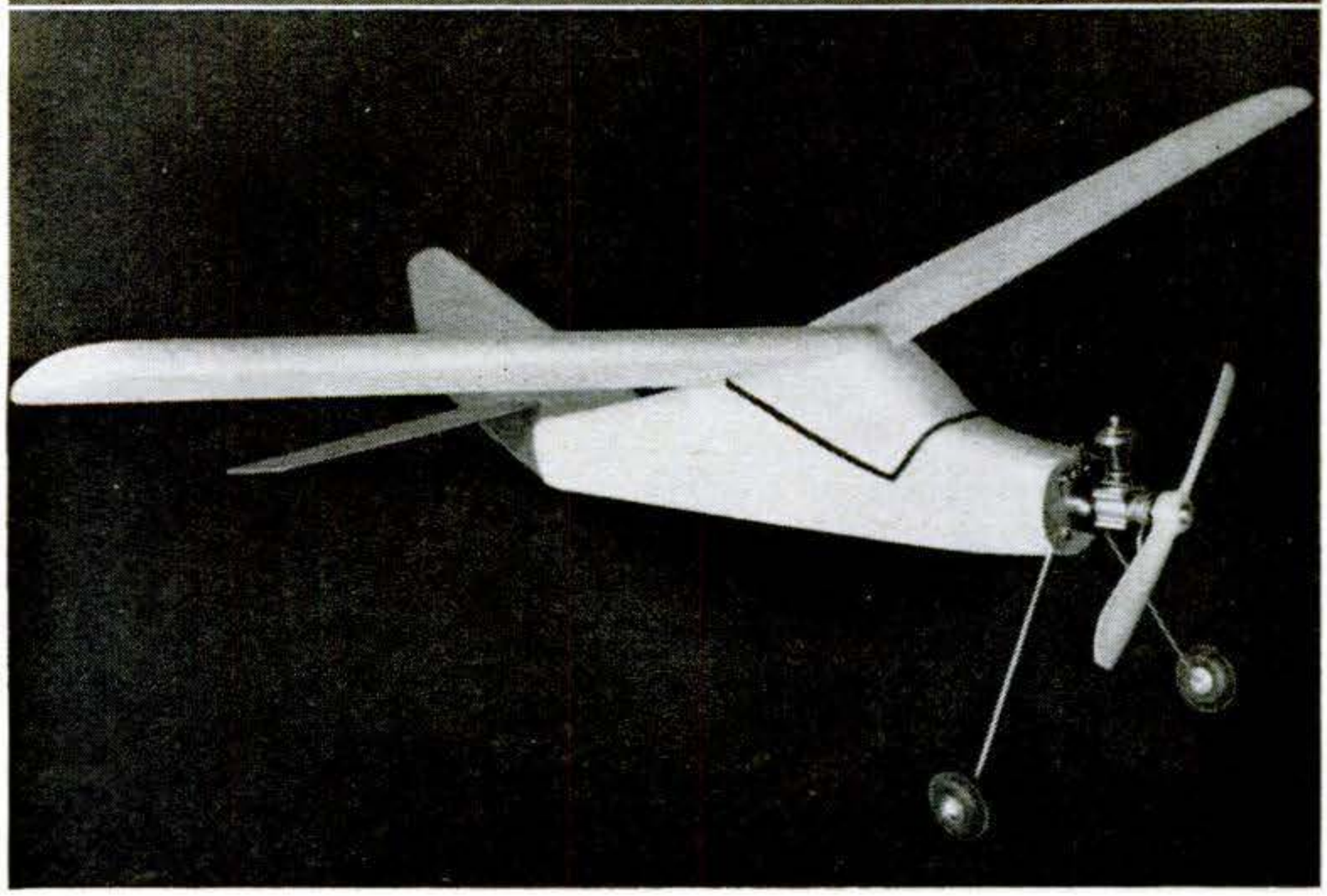
Big tail fin helps give the little feather-light ship good flying stability. Wheels are 1″ in diameter, mounted on bent music wire. Black tissue strips outline the cabin window.



Engine firewall is an oval of thin plywood cemented to the Styrofoam nose. The wire for the landing-gear struts is notched into the Styrofoam behind the firewall. A Cox .010 engine gives adequate power. For a bit more speed, try an .020. The slightly rough texture visible in the wings has no effect on performance.



The tail surfaces are made of sheet balsa. Cement a few lengths of soft iron wire to the underside of the elevator so adjustments will remain bent in. The motor is mounted on thin plywood.

Assemble the model with polyvinyl cement (white glues such as Elmer's Glue-All). Do not use plastic cements or regular model-airplane cement, or the foamed styrene will melt like snow on a hot stove. Allow at least 24 hours for drying.

The tail surfaces may be doped—I used bright red for contrast and it looks very lively in the sky. Do not put dope or paint on the Styrofoam. Glue a band of heavy-weight model tissue around the nose to cover any seams between the firewall and fuselage. The cabin-window outline is black tissue glued on. A thin coating of glue can be rubbed over the nose to prevent fuel penetration.

It's a good idea to limit the run of the motor with a few clean ball bearings in the fuel tank. (I lost my first plane on its first flight!) The model can be made to fly in large circles by twisting the elevator up slightly on one side. Left-hand circles are best since they make use of the prop's gyroscopic effect to help hold the nose up. Adjusting the rudder isn't necessary if you get it on straight. ■ ■

PARTS LIST

1 block ½″x12″x12″ Styrofoam
1 block 1½″x6″x12″ Styrofoam
1 sheet 1/16″x3″x10″ balsa
1 sheet ⅛″x3″x8″ balsa
1 piece ⅛″x1½″x1¼″ plywood
2 rubber-tired wheels, 1″ o.d.
4 2-56 screws and nuts for motor
2 washers, 1/16″ hole by ¼″ o.d.
Music wire, 1/16″x9″
Cox .010 motor and prop
Polyvinyl cement, scrap black paper, red dope

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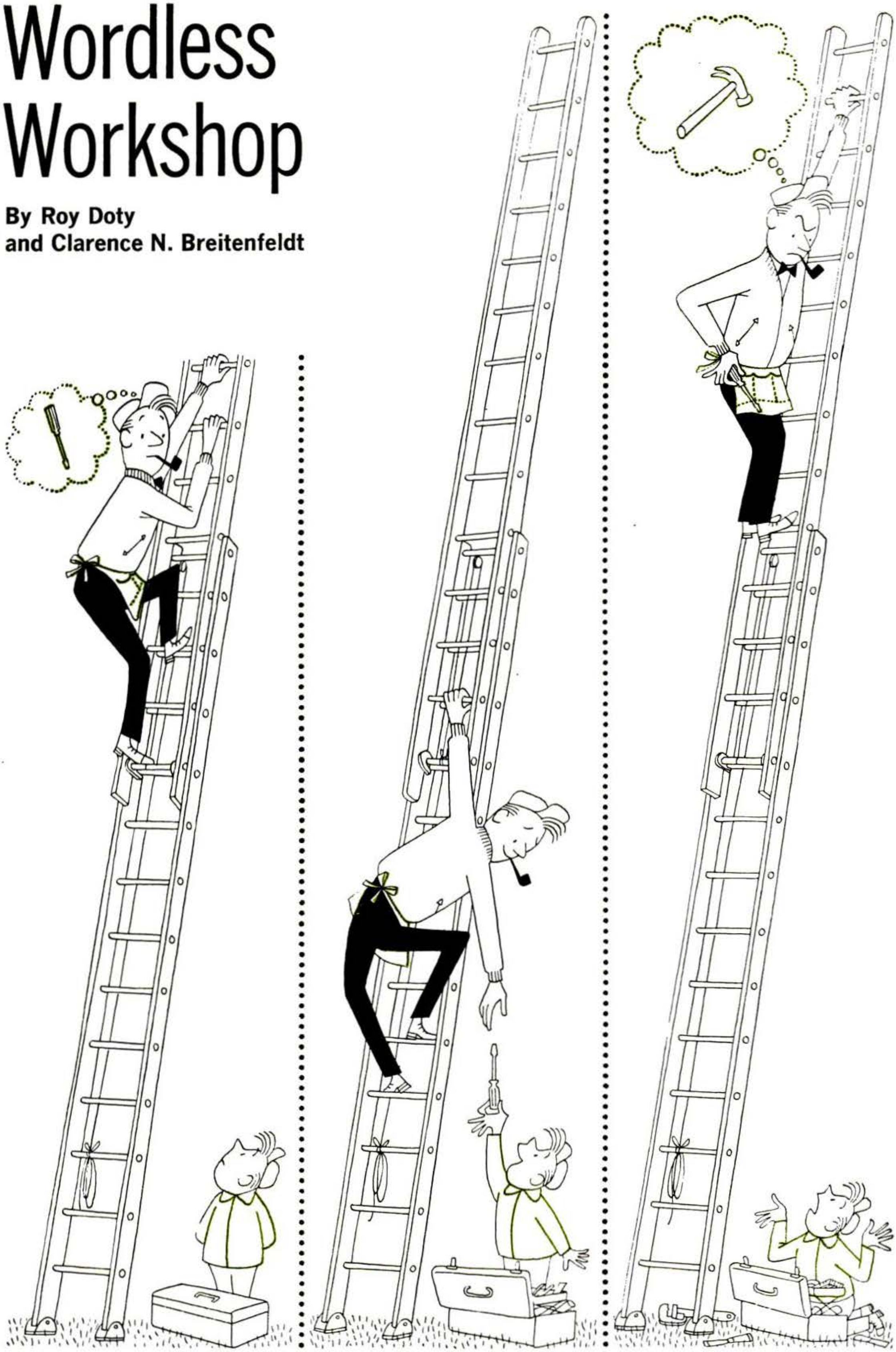
Wordless Workshop

By Roy Doty
and Clarence N. Breitenfeldt



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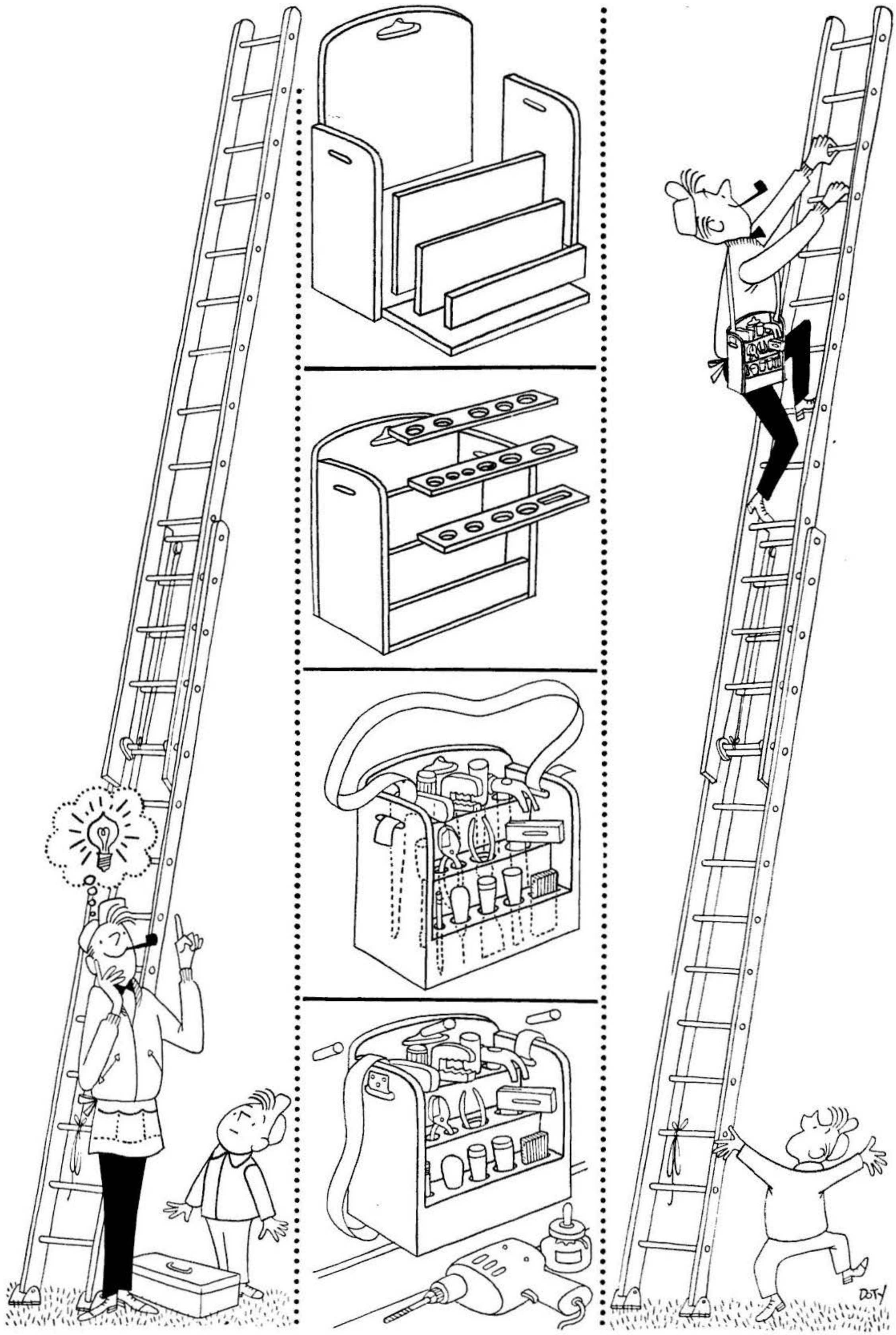

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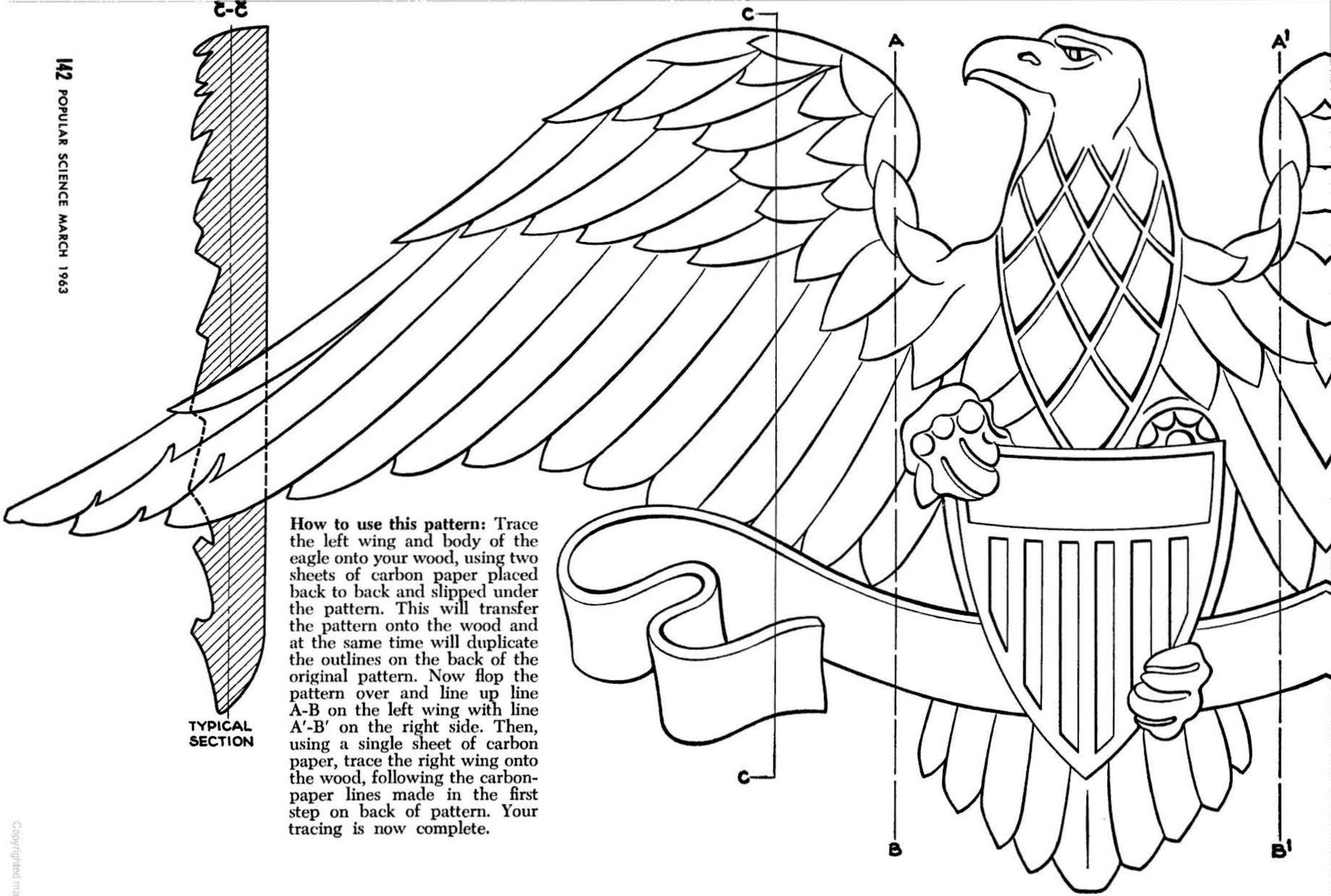

How to use this pattern: Trace the left wing and body of the eagle onto your wood, using two sheets of carbon paper placed back to back and slipped under the pattern. This will transfer the pattern onto the wood and at the same time will duplicate the outlines on the back of the original pattern. Now flop the pattern over and line up line A-B on the left wing with line A′-B′ on the right side. Then, using a single sheet of carbon paper, trace the right wing onto the wood, following the carbon-paper lines made in the first step on back of pattern. Your tracing is now complete.

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Carving Wood with Power

A classic Federal Eagle makes a fine subject for shop-testing a new high-speed grinder-carver

By Phil McCafferty

THIS handsome Federal Eagle combines an ancient art with modern power tools. Instead of spending endless hours carving it by hand, you can shape its lines effortlessly with a small high-speed grinder. Tiny rotary cutters do the work while you merely guide the tool.

The full-size pattern on the opposite page makes the job of drawing the eagle easy. You simply trace the pattern directly onto the wood. To get the eagle's right wing, you reverse the left one.

While any high-speed hand grinder or flexible-shaft tool will work well, POPULAR SCIENCE used the eagle as an opportunity to try out Dremel's newest grinder, the Moto-Tool No. 3. The tool turns at a sizzling 2,700 r.p.m. and has considerably more power than its predecessor, the No. 2 Moto-Tool. Its biggest accomplishments are greater sustained torque and much less loss of speed under load—long a problem in the design of these tiny, fast-turning tools. Making delicate cuts, even in hard materials, proved to be a breeze.

Choosing the wood. You'll need a block 6½" by 15½" and at least ½" thick. Select a wood that's free of wild grain and knots.

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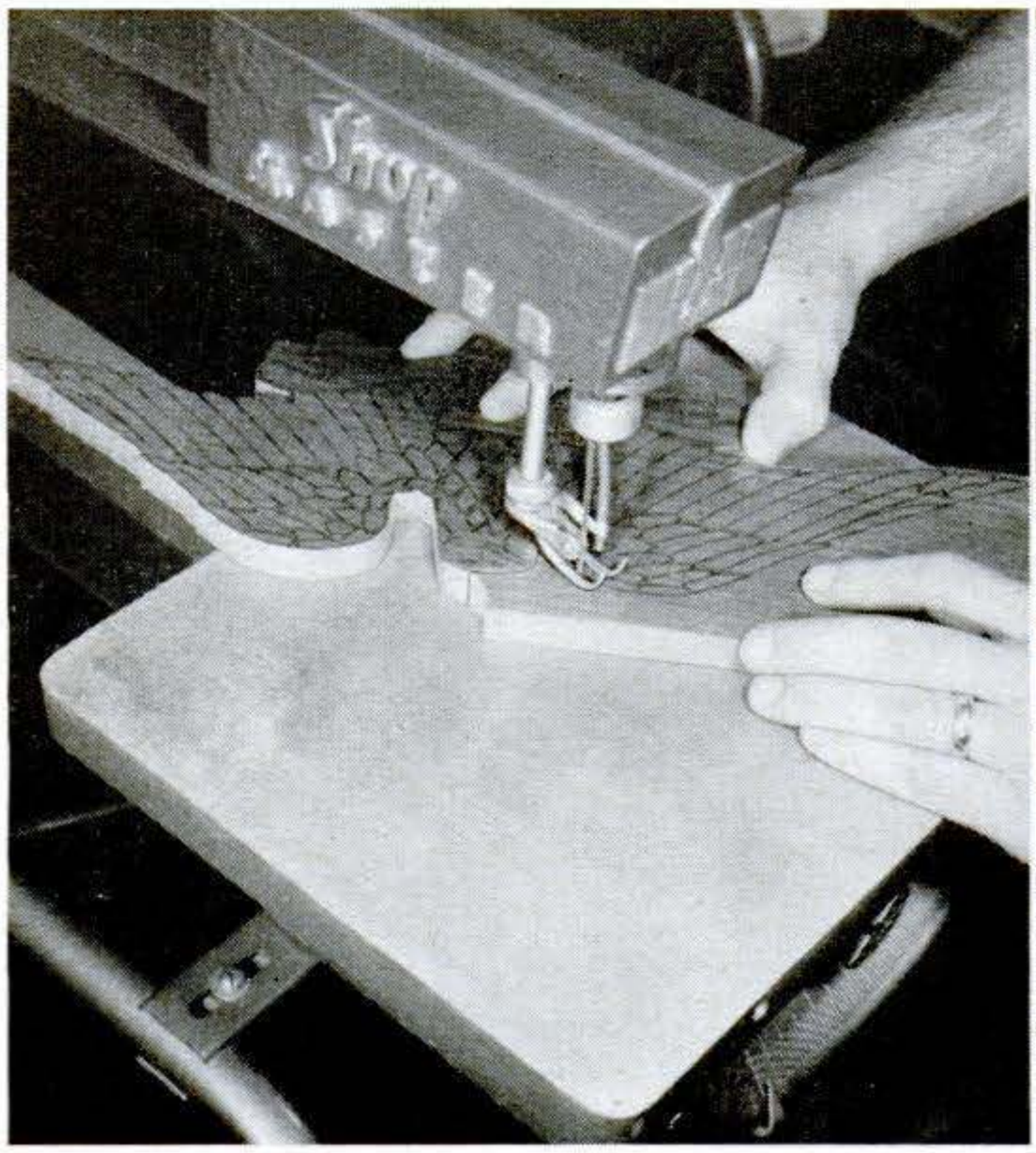
You use the grinder like a miniature router. Here are carving



Jigsaw the eagle's outer contour before carving the details. Spraying the surface with acrylic lacquer first will keep the carbon-paper outlines from being smudged during carving.

Trace the knee and claws on extra ¼″ stock and rough-carve before cutting them free. Then glue them on top of the shield and finish carving to blend the lines into the main pattern.

Straight-grained walnut is ideal. When finished naturally, its rich color gives the warm look of an antique to the carving. Honduras mahogany and maple are good choices for lighter tones. Don't use softwoods or plywood. They chip and gouge too easily.

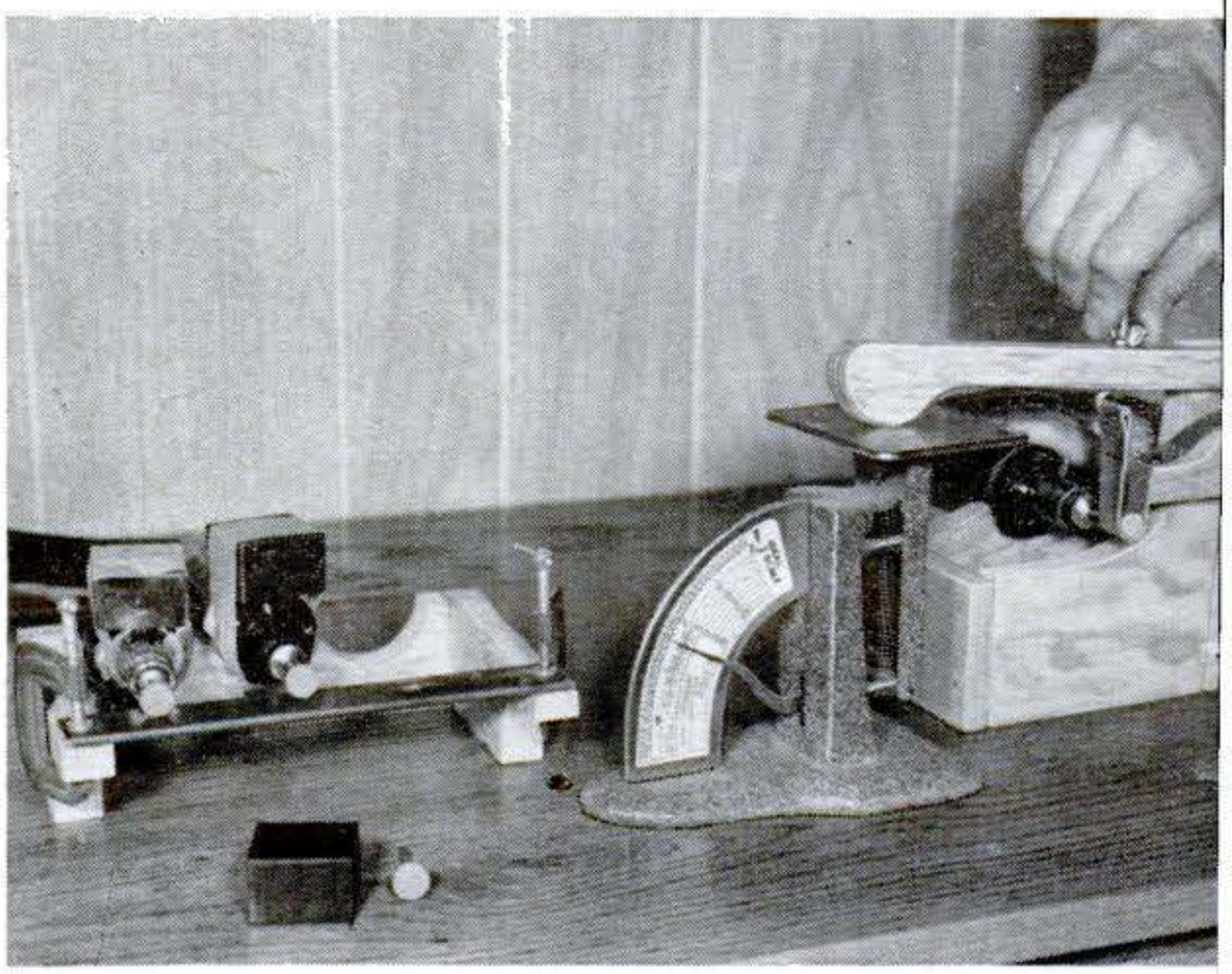
For a gilt finish, or grainless wood-tone colors, use Masonite Duolux hardwood-fiber tempered hardboard. This material has excellent power-carving characteristics. It is generally available only in ¼″ thickness, so glue up two pieces to get the ½″ thickness required.

Practice on scrap material before embarking on the eagle. Start the carving with roughing cuts before making any final, decisive cuts. Outline the cap feathers with undercuts. Study the photo to see how the cuts are made to achieve a three-dimensional effect.

Carving the eagle offered a good chance to see what the added weight of the Moto-Tool would do—the new model is almost half again as heavy as many tools of this type. Oddly enough, the extra weight doesn't bother you, and even seems to give your cutting strokes more purpose. The tool runs much cooler than many lighter models and the overall effect of cooler operation, plenty of power, and good heft make it a real performer.

Finishing the eagle. Final cuts should be light and even to get the best possible finish, because it is virtually impossible to sand the carving thoroughly. Sharp edges can be smoothed with an overall sanding, using fine paper. Use a rotary wire brush in the power tool collet to clean the recesses of the carving.

Finish the eagle with two brushed-on coats of an equal mixture of white shellac



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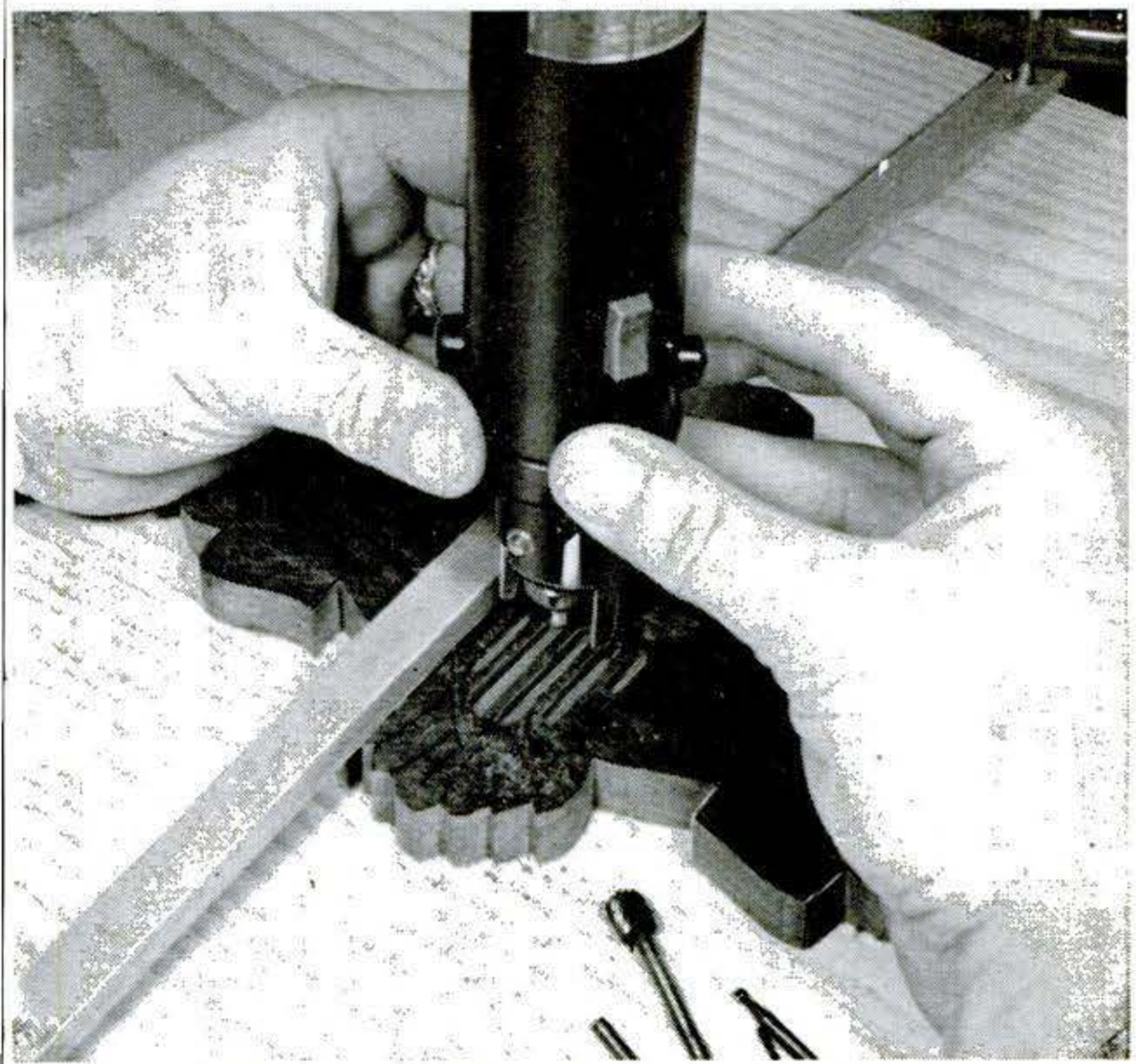
pointers to help speed the job



Clamp a guide strip across the carving to make the straight cuts in the eagle's shield. Use a ⅛"-diameter cutter for this, and square off the ends of the grooves with a smaller cutter.

and boiled linseed oil, rubbing off any excess. Or use a gloss or satin polyurethane varnish. Top either off with wax polished with a mandrel-mounted felt buff.

For a gilt finish, spray the carving with two coats of acrylic lacquer to seal the wood. After thorough drying, spray on two coats of metallic gold lacquer. To duplicate the antique look of a weathered brass casting, spray the well-dried gold finish with flat-black paint, and then quickly wipe off the wet paint from all but the carved recesses.

The Moto-Tool No. 3 is a fine example of miniature hand grinders at their best. Often thought of as "hobby tools," such grinders are actually versatile and rugged shop tools. Hundreds of shapes and sizes of cutters, rotary files, abrasive wheels, and brushes are made to fit them. Besides carving, some of the many jobs they'll do are drilling holes, grinding off spot welds, sharpening blades, routing out metal, and making mortises in wood.

The Moto-Tool No. 3 sells for $29.95 from Dremel Mfg. Co., Racine, Wis. ■ ■

How the new hand grinder rated in Popular Science tests

To check its power, the No. 3 Moto-Tool, along with several other grinders, was put through the tests shown at left. At near left, the tools were clamped in a pony brake, and their frictional pull on the pivoted arm—a measurement of torque—was recorded on a postal scale. At far left, the grinders were placed in a cradle, weighted with steel blocks, and forced to grind a variety of materials: wood, steel, brass, bone, plastic, and glass. The material ground away in a given time indicated each tool's cutting speed.

In all tests, the results showed the No. 3 Moto-Tool to be at least 50 percent more powerful than the older No. 2 model. It also generated much less heat.

The No. 3 weighs 17 ounces, four more than the No. 2, and is about ¾" longer. This slight increase in heft did not prove objectionable. The tool is rated at .9 amp —almost double the No. 2's .5 amp.

One complaint: The grinder's case is fitted with a formed-plastic tool compartment and cutter holder. The plastic was found to flake off easily and catch dirt.

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PS TOOLS

All-Purpose Table for Portable Tools

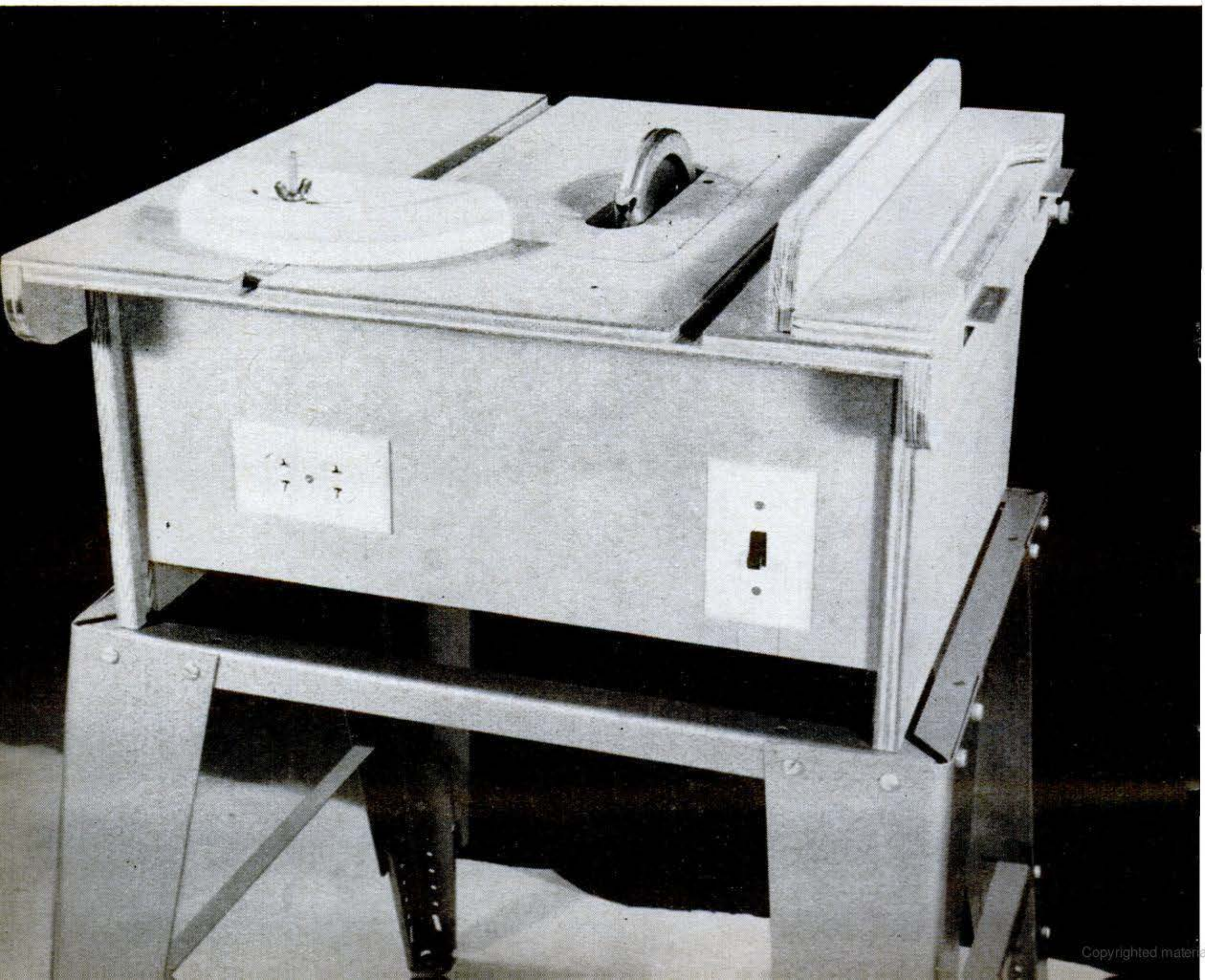
You get double duty from hand-held power tools with this table: To their flexibility it adds the precision of stationary tools

By R. J. De Cristoforo

HAND-HELD power tools are efficient time and muscle savers for on-location jobs. But they can't match the convenience and precision of stationary power tools when you move into the shop for fine cabinetry and furniture making. Build this multipurpose table and you can enjoy the advantages of both kinds of tools.

The table is made like a sturdy box with a hinged top. The big 23″-by-23½″ top provides more useful working surface than most 8″ circular saws. It is completely portable—you can set it on a bench or sawhorses, or provide legs to make it free-standing. There are interchangeable inserts for each hand-held power tool.

Most of the construction work can be done with your portable tools. Cut the dadoes with your cutoff saw by setting



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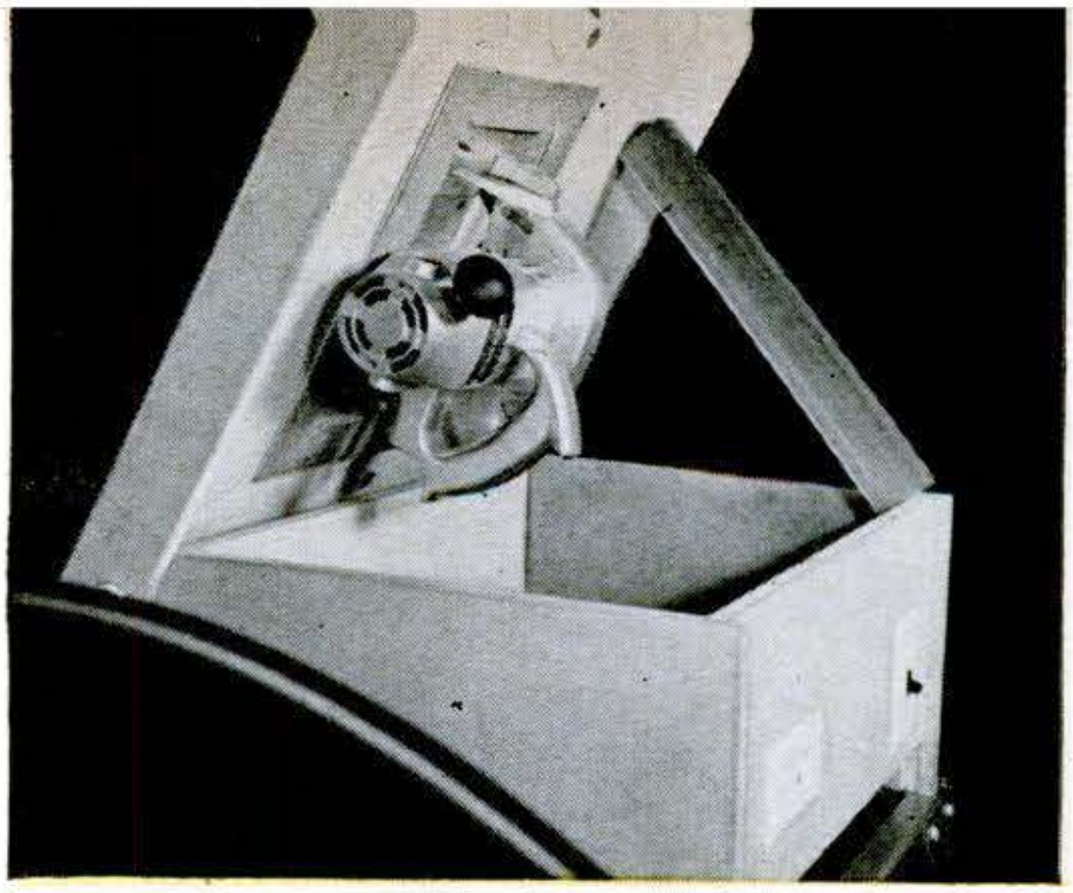
blade projection to the required depth and making repeated passes side by side. Use a straightedge clamped to the work to guide the saw. To cut slots, drill a series of overlapping holes on a common centerline and clean it up with a file. Make internal cutouts with your saber saw.

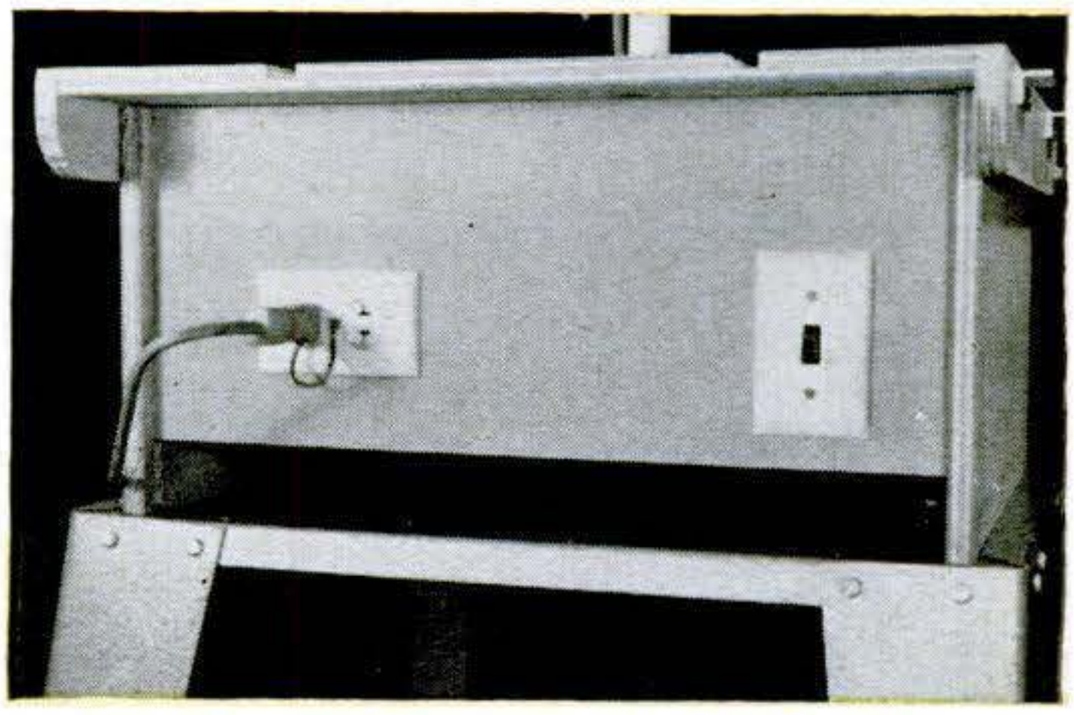
Take extra care to cut the dadoes in the table top parallel to table opening and table sides. Since these will be the guides for the miter gauge, the accuracy of the finished machine will depend on the precision of these grooves.

Complete all parts for the table saw first; you can then use your new "stationary" saw to speed the rest of the work. Make a separate insert for each tool you plan to mount, adapting it to accomodate the specific tool. Except for the drill, tools can be easily mounted on the underside of the insert with holes through their baseplate.

Sand all surfaces smooth, and finish with three coats of resin floor sealer. Rub with fine steel wool, apply a hard wax, and polish.



Top pivots on two ¼" bolts so it's easy to mount any tool that won't fit through the table opening from above.



Switch-controlled outlet is fed by three-wire cord with grounding plug. Lock tool switch "on" and use table switch.

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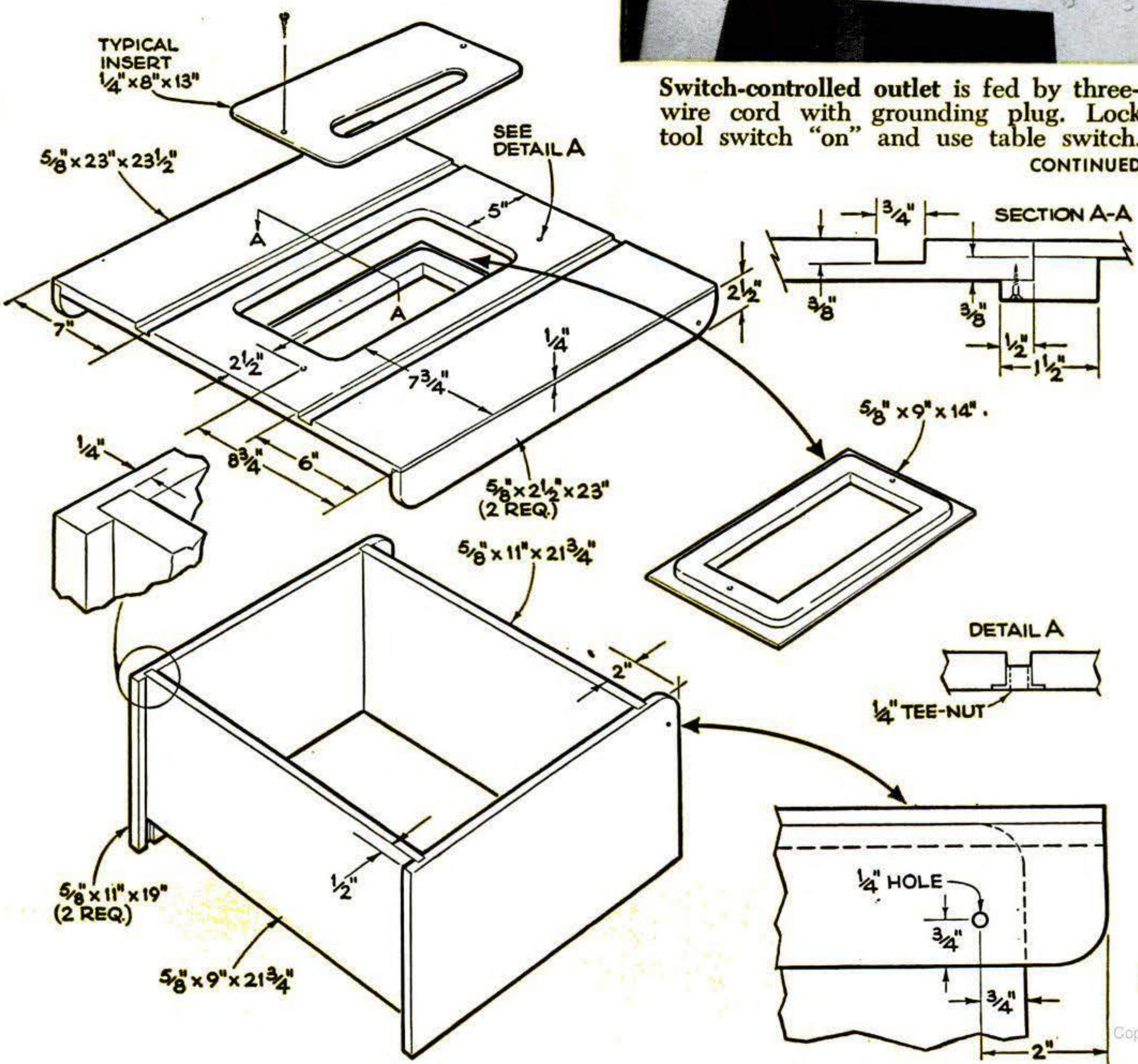

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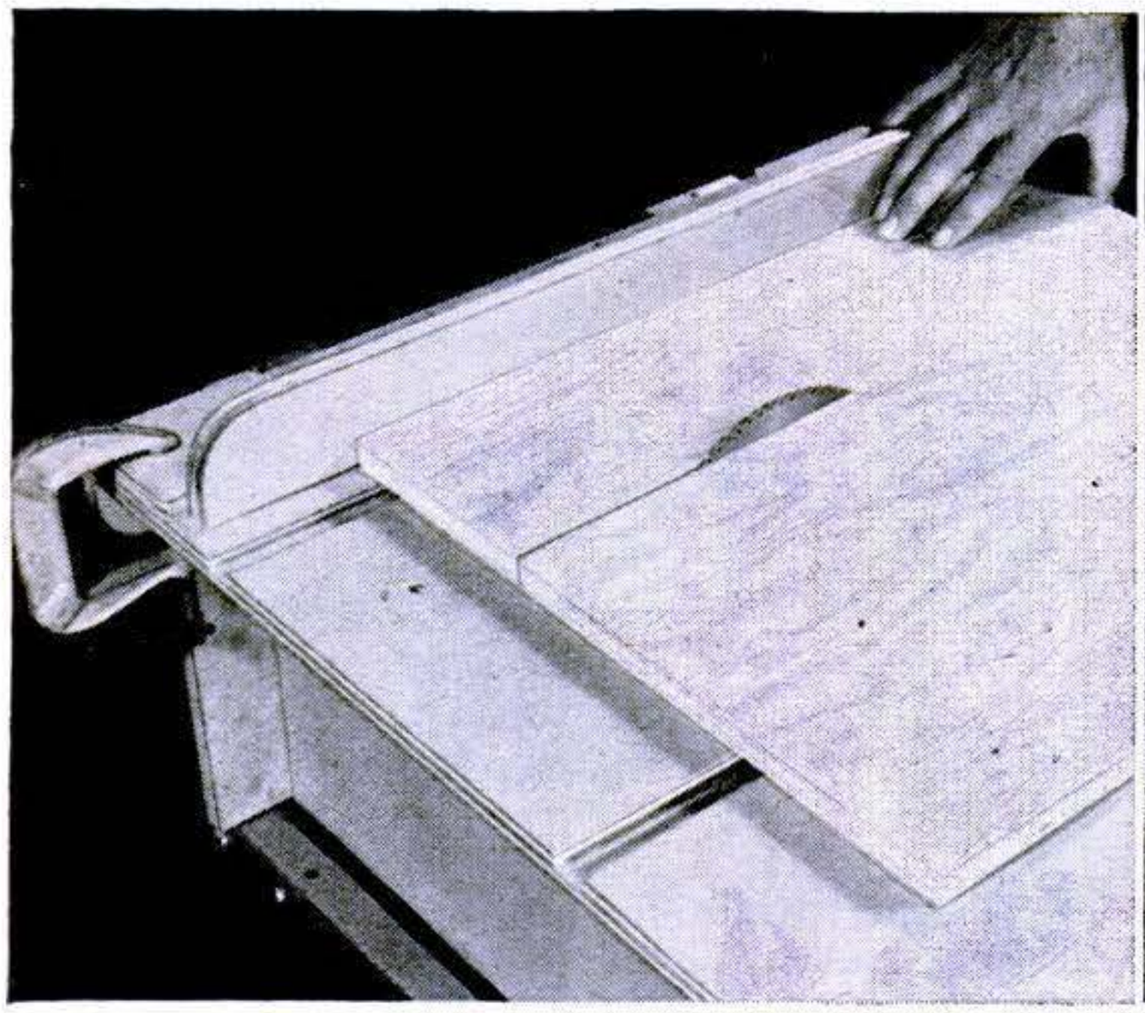
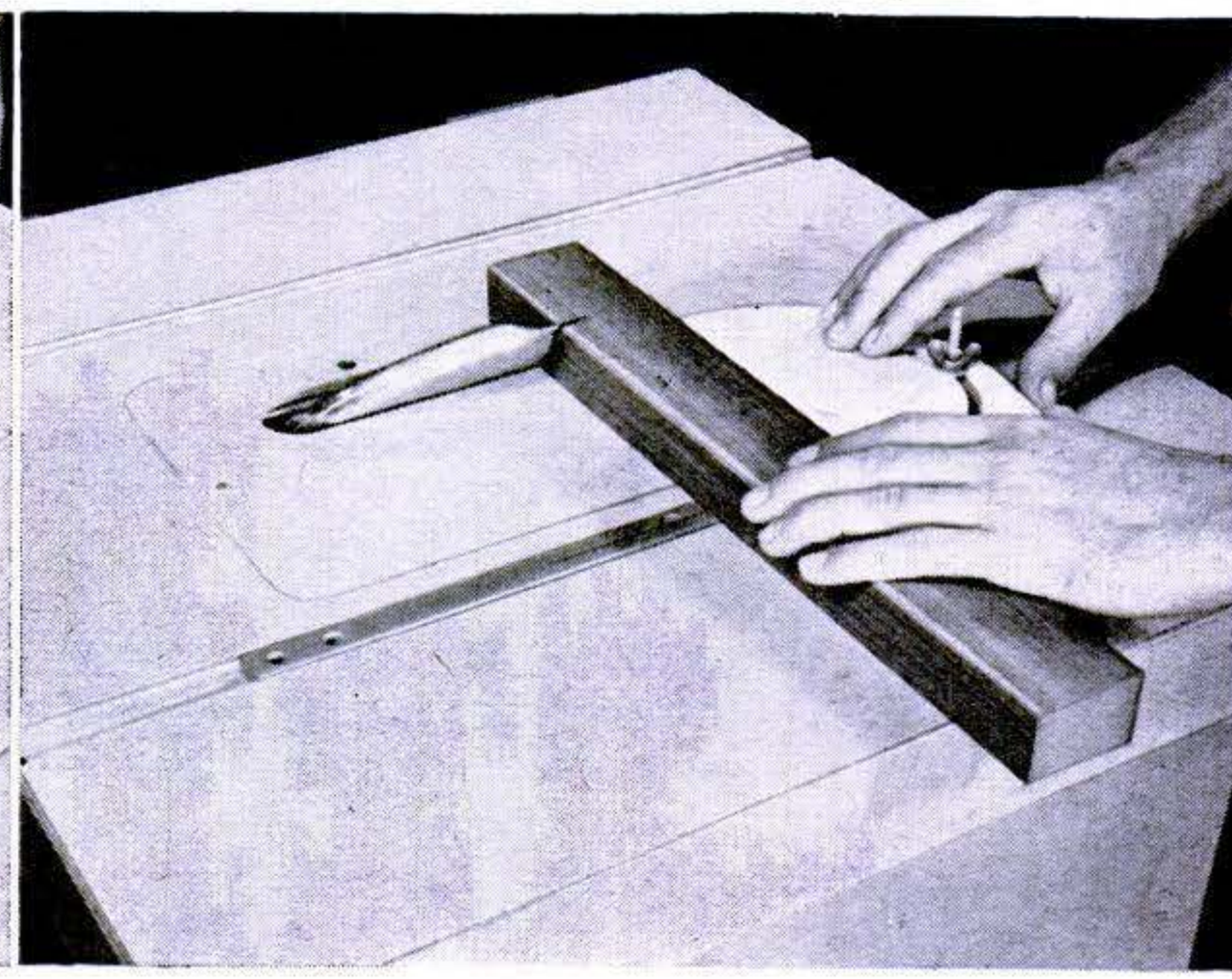
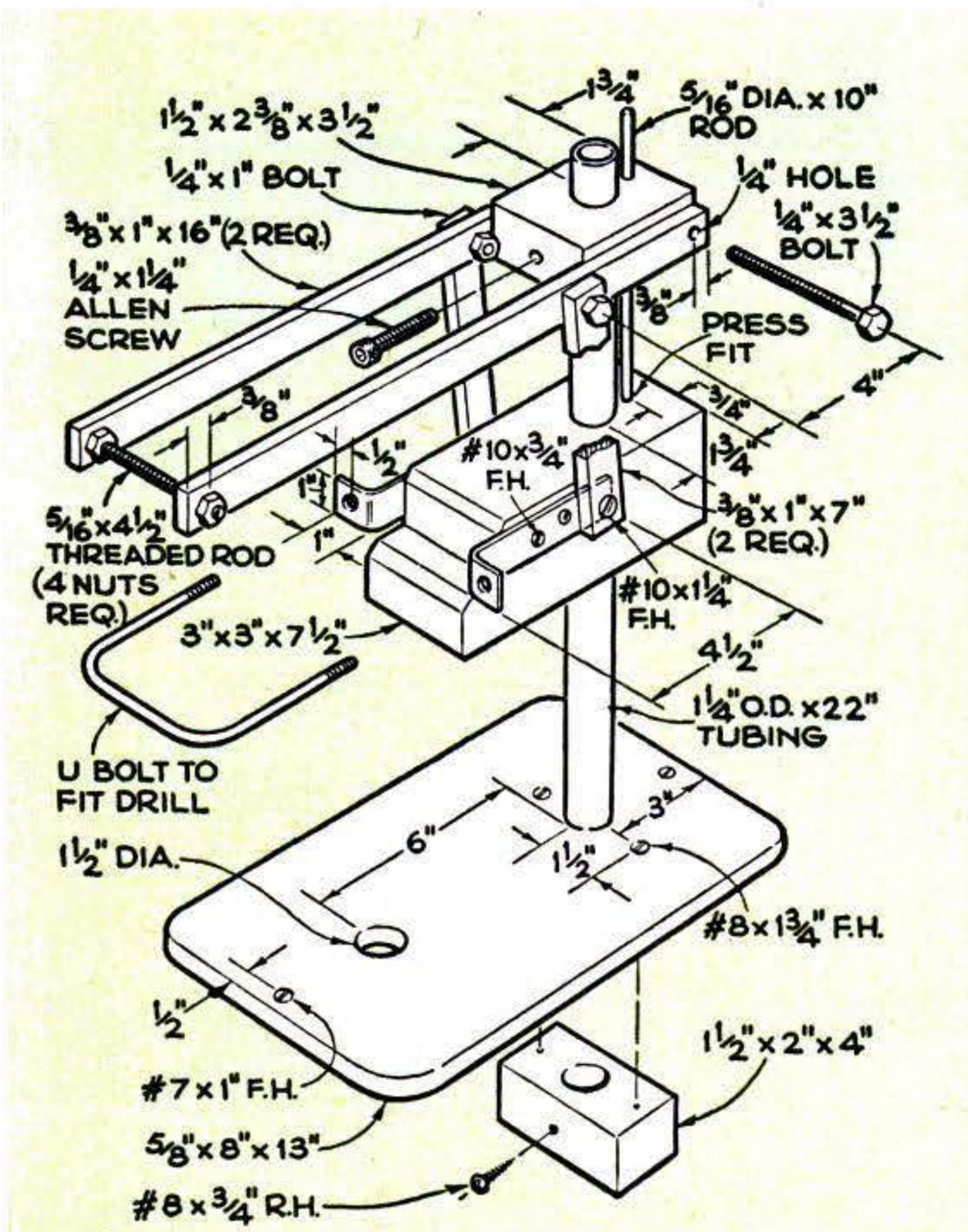
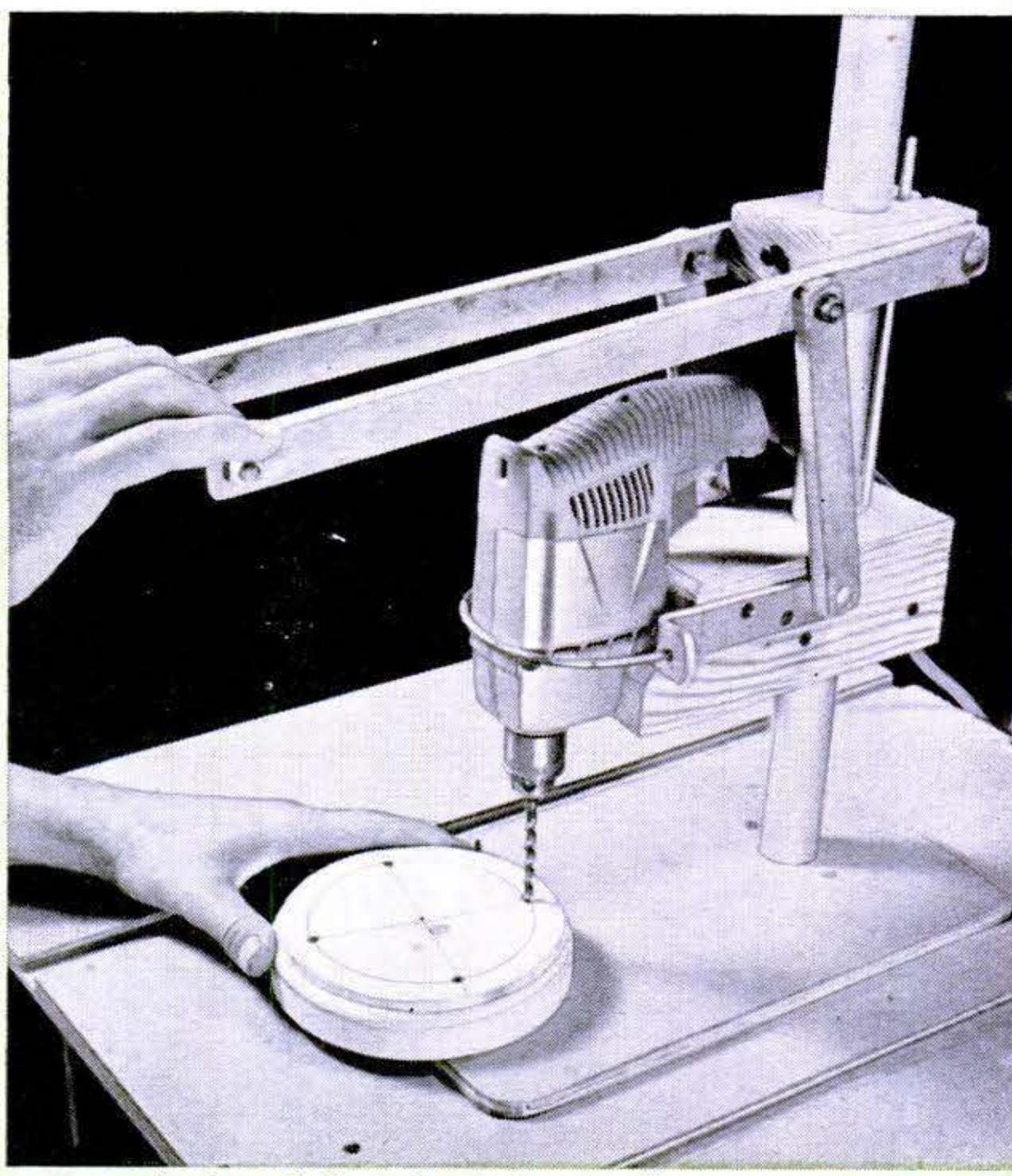
The table saw made from your portable cutoff saw has a





Drill press adds convenience and precise control





Drill press may have to be modified in some details to fit your drill, but the basic design will work for most. Shape front end of the drill mounting block to fit the case of your particular tool. Be especially careful with this step because the drill bits must work parallel to the column. Final adjustment can be made with sheet-metal shims between drill case and mounting block. If you have trouble finding a U bolt that will work, you can easily bend one out of threaded rod. Hole in the mounting block should be a snug fit on the column, but free enough to slide. Wax inside the hole will help. The guide rod is best made of 5/16" drill rod, but cold-rolled steel will do. It should be a tight press fit in the drill mounting block and a smooth sliding fit in the lever support block. Tighten bolts in linkage just tight enough to keep drill from sliding down of its own weight when left in the raised position.

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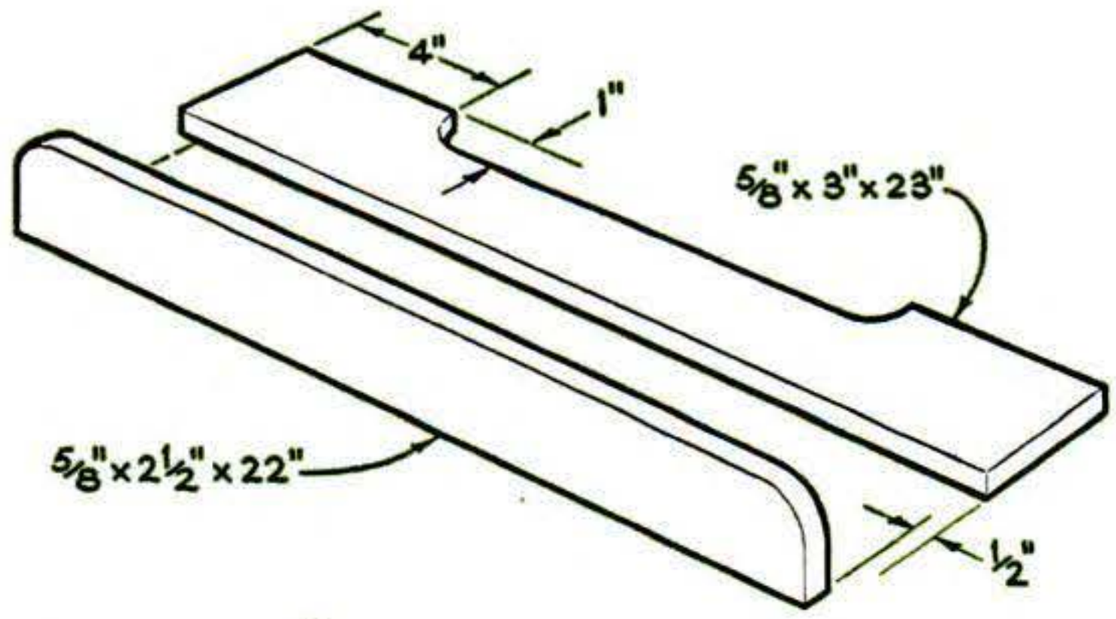
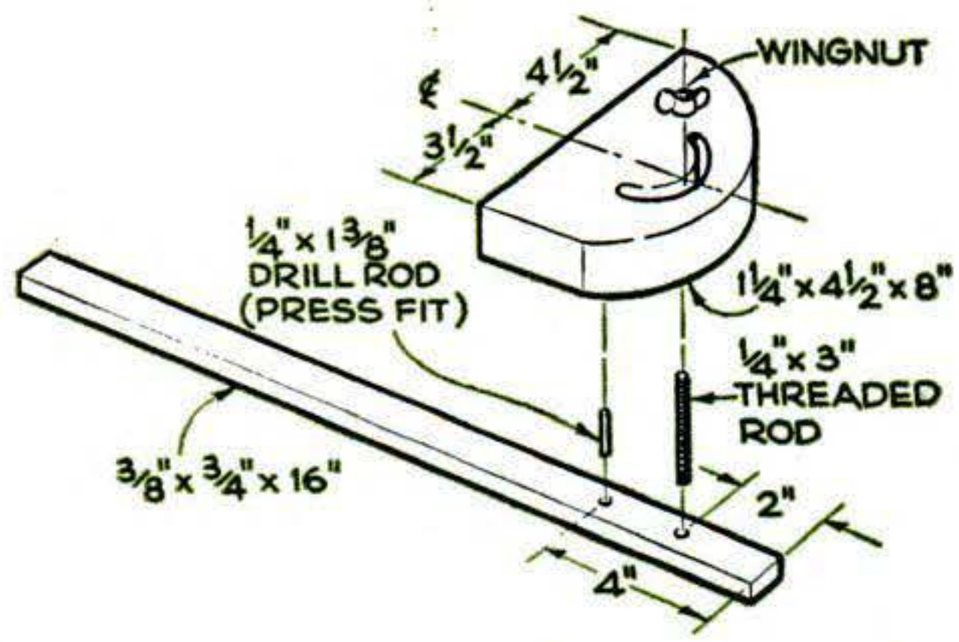
tilting arbor and more work surface than most stationary saws

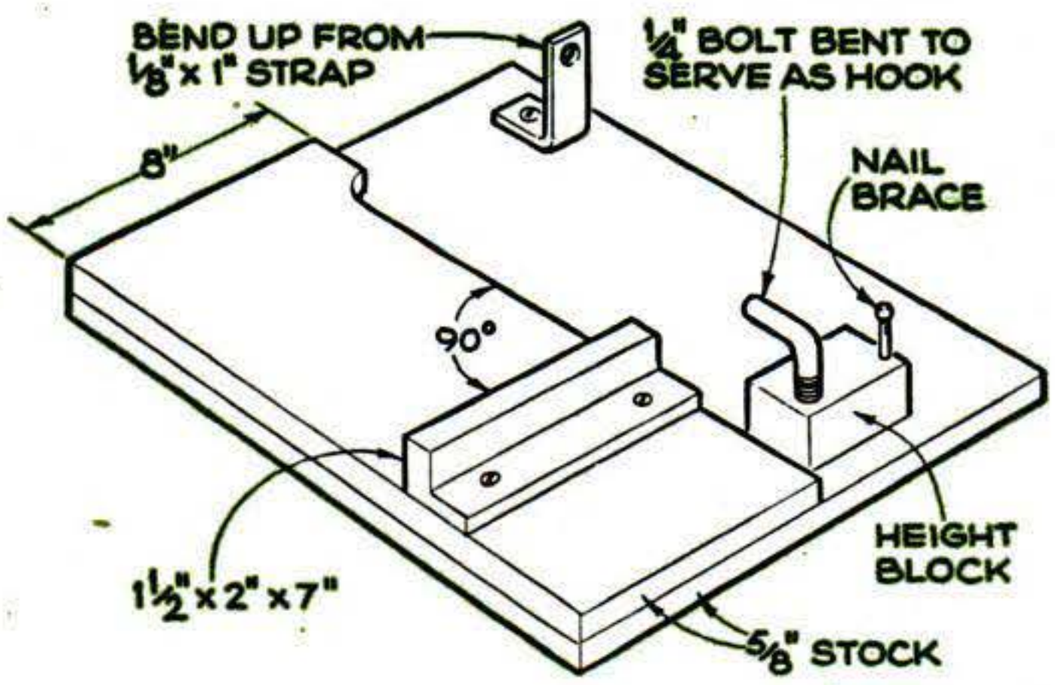




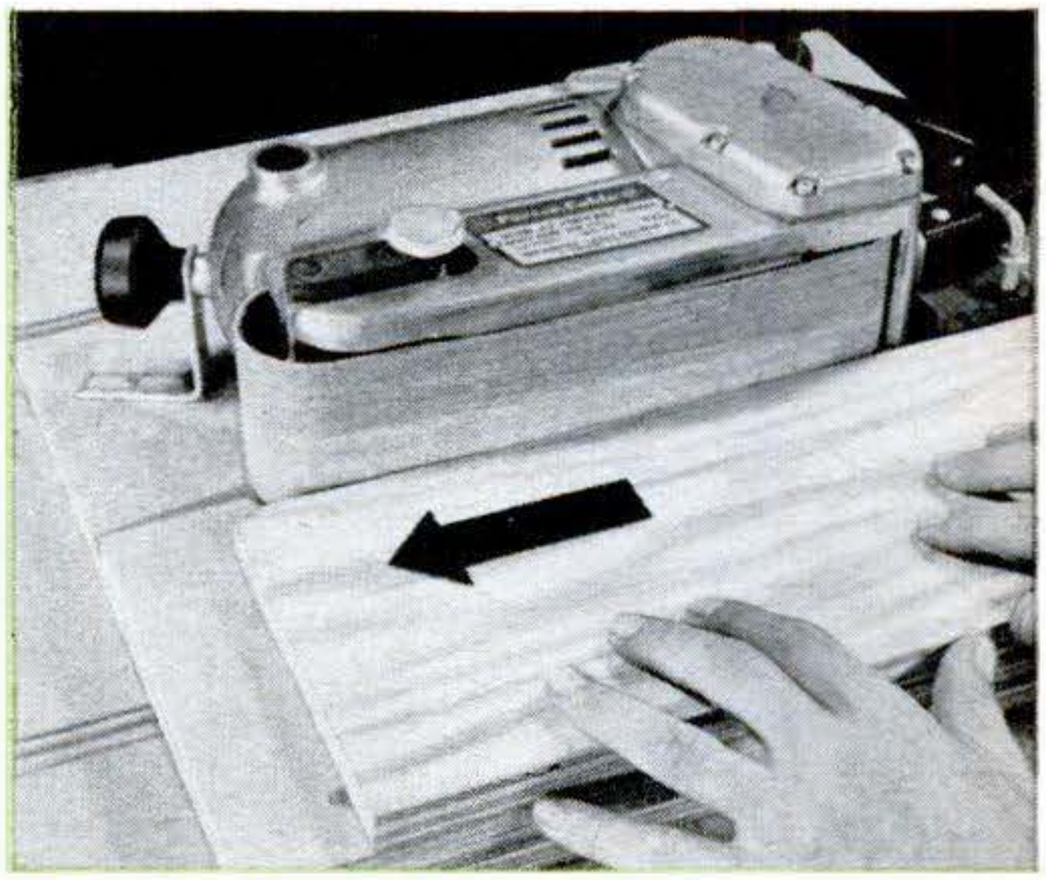
Rip fence is simply two pieces of hardboard-faced plywood, shaped as shown, nailed and glued together at right angles. For accurate rips-to-width, set fence parallel to blade and clamp the fence to the table with C clamps.

Miter gauge uses a surplus miter-gauge bar, but any bar stock—or even a piece of hard maple—will do as well. Use hardwood for the head. Note the tilting arbor—make slot wide enough to use the saw's own tilt feature.

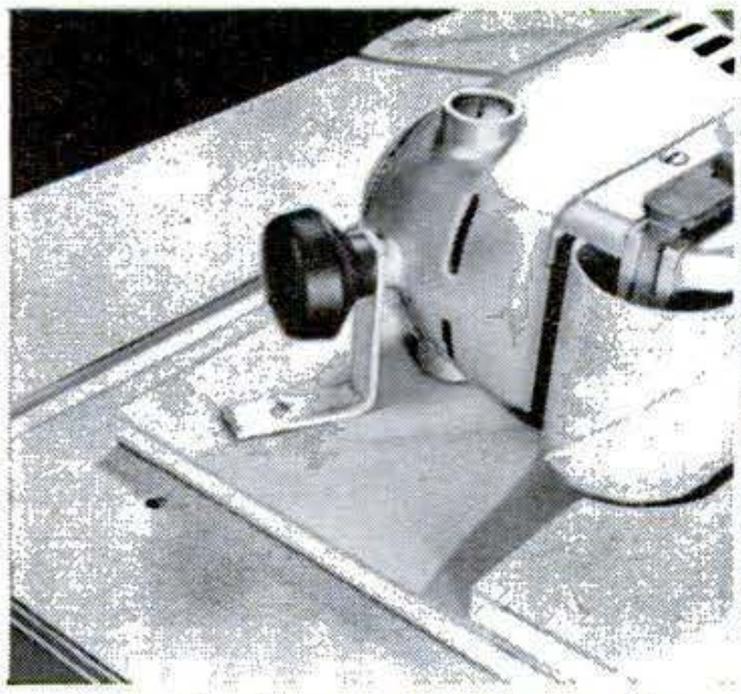
Mounted belt sander is a great work- and time-saver



Belt sander requires a mounting of its own, but a standard insert can be attached to the underside so the assembly can be fitted easily to the table. Raised work surface follows belt contour for sanding curves.

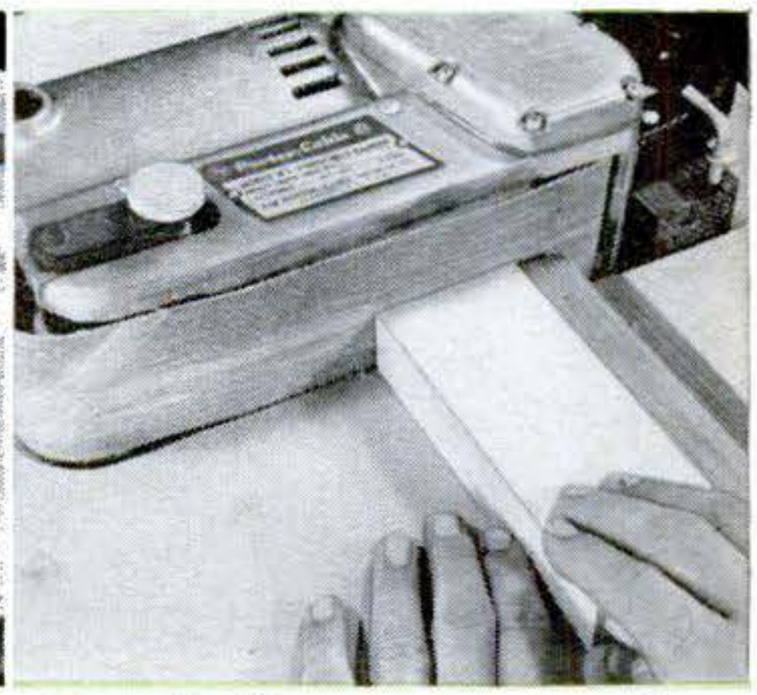


Direction for feeding work into sander is shown by arrow. Work should be moved in direction opposite to that of belt travel.



Use knob to attach sander. Bend 1/8" strap steel as shown and drill hole to hold sander 1/8" off platform.

Clamp handle end of sander on height block. Use an L-shaped hook made of 1/4" bolt with head removed.



Detachable stop is a valuable addition to the sander table for smoothing and truing the ends of boards.

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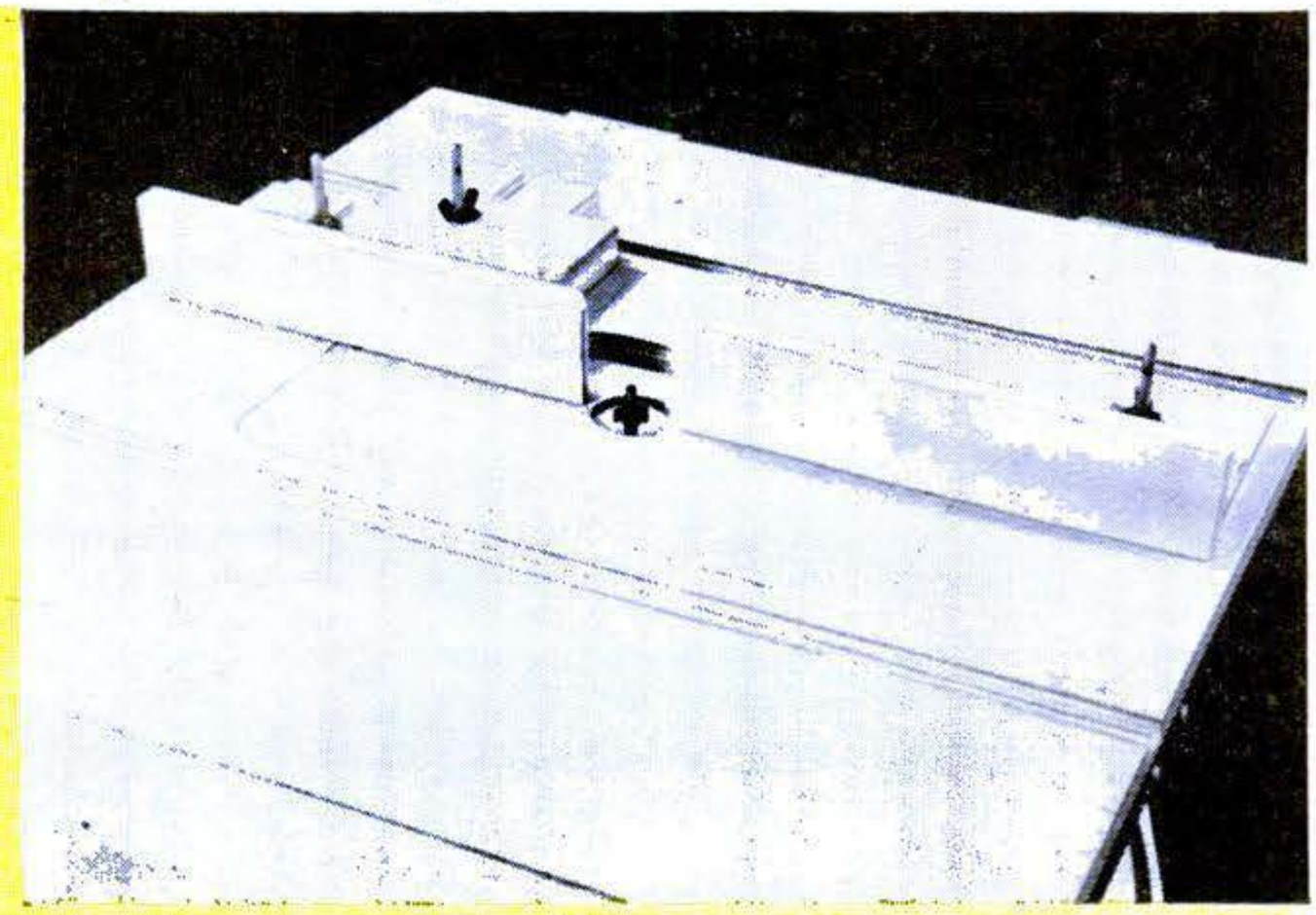
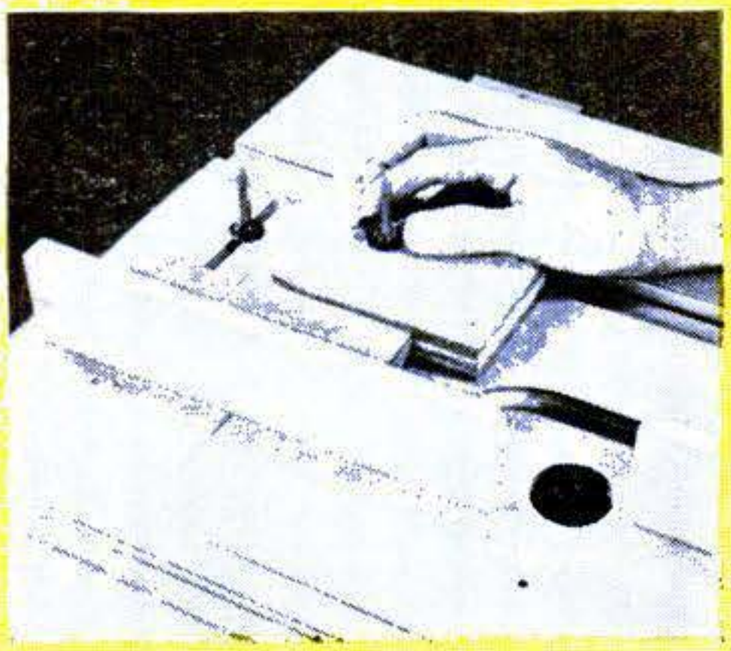
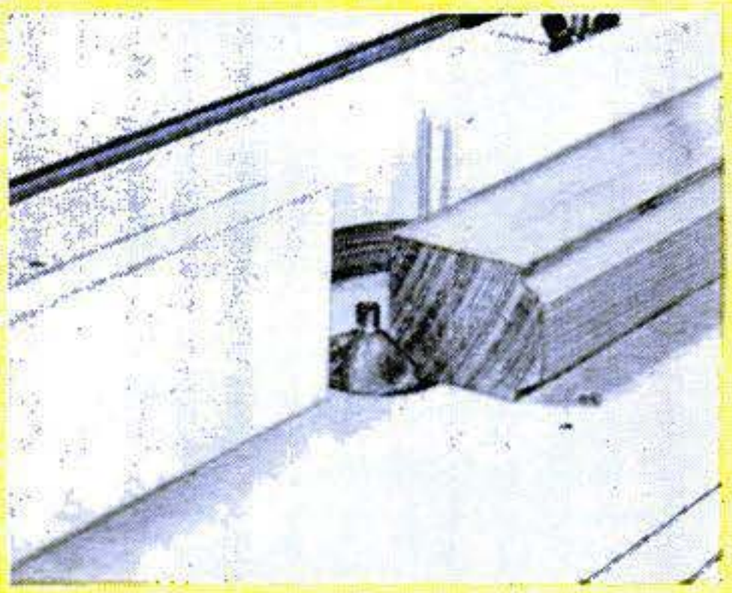
Router becomes an excellent jointer-shaper

Router arrangement, with adjustable-fence setup, is as close as you can come to a shaper, short of the real thing. Depth-of-cut adjustments are made with router's own adjustment—width of cut, with fence.

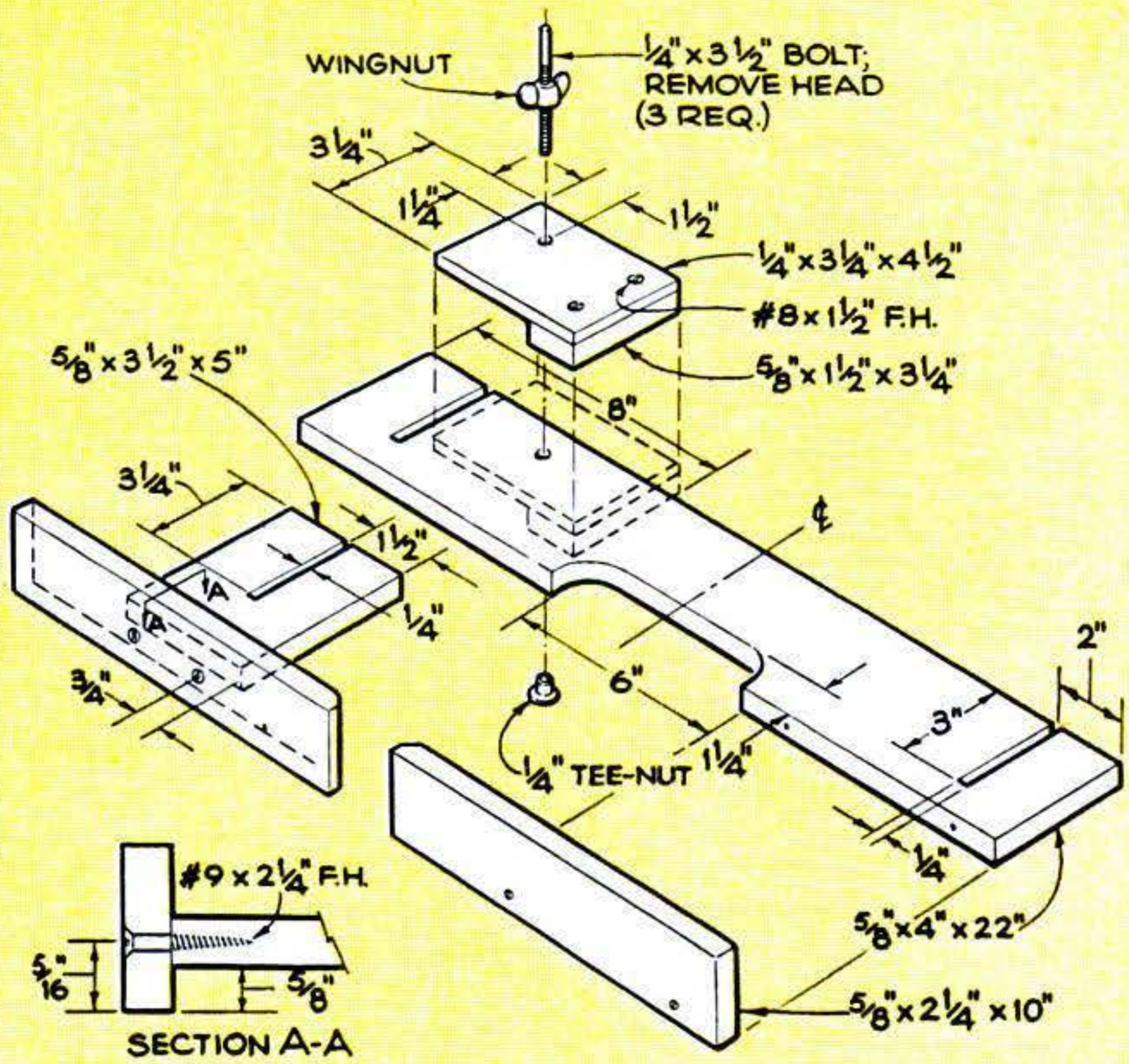




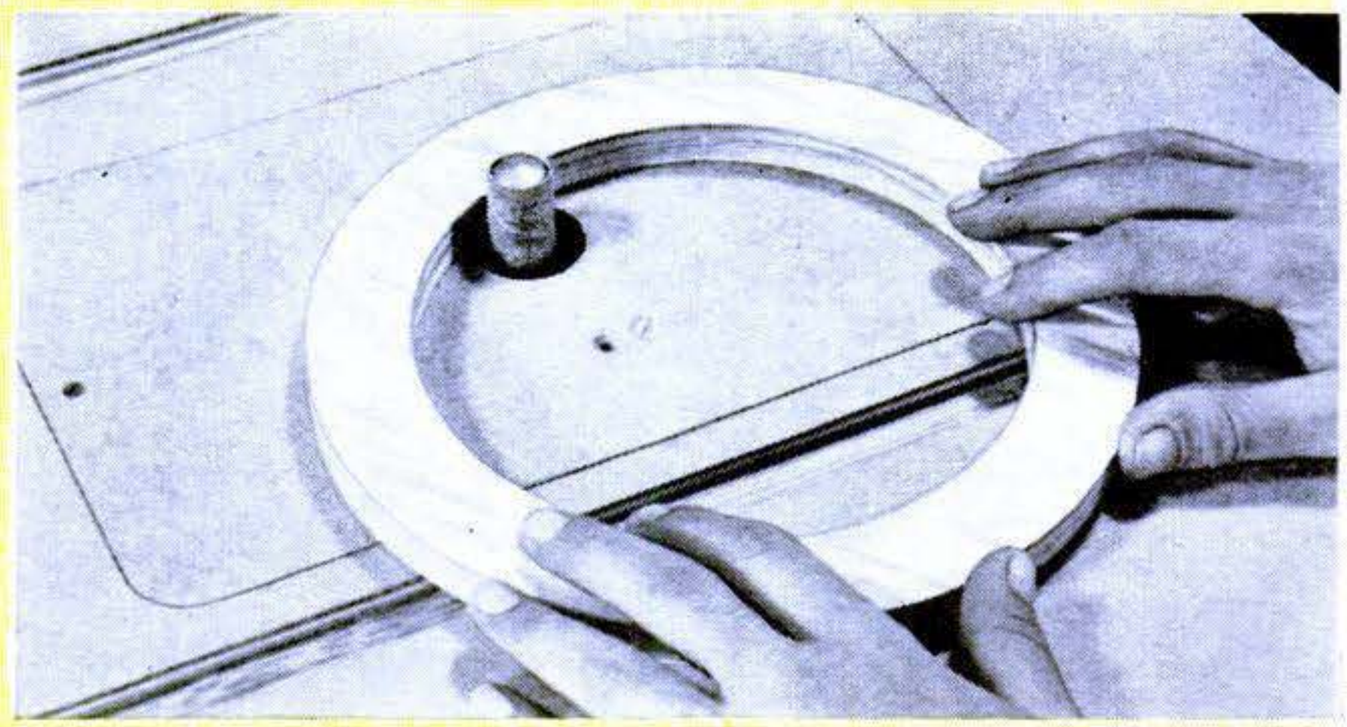
Outfeed fence adjusts independently. When back, it is in line with infeed fence. They must be kept parallel.



Adjust fence as a unit to set depth of cut when only a portion of the stock edge is to be removed by the cut.



Outfeed fence projects beyond infeed fence by the depth of the cut when entire edge of the stock is to be removed.



Small drum sander may be mounted in the router for light sanding, but as speed of any router is excessive, apply very little pressure. Same setup is used for freehand shaping of curves using collars or bits with pilots. ■ ■

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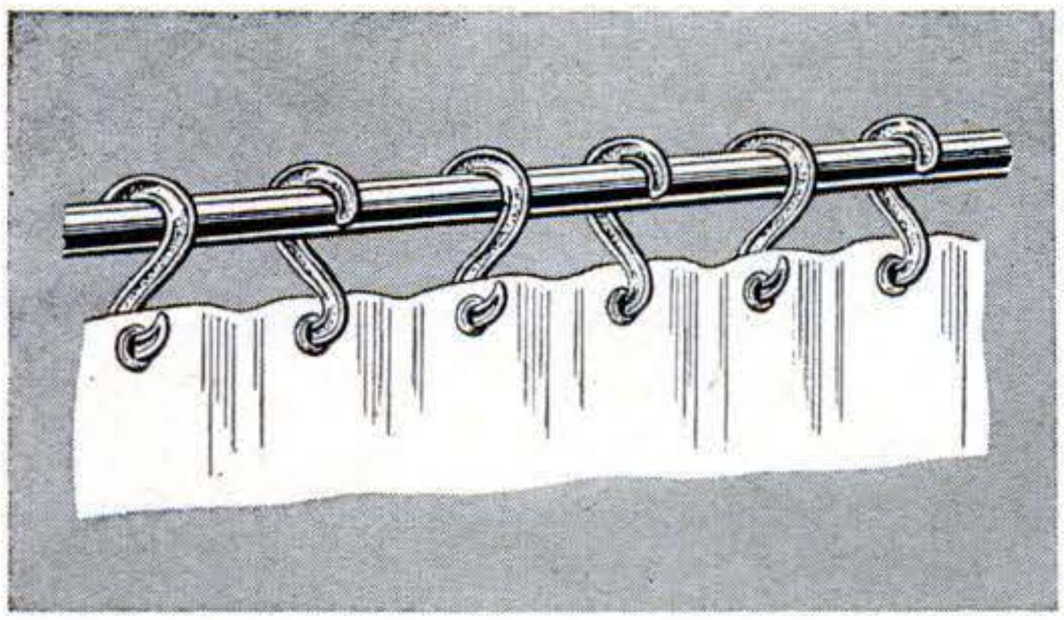
Short Cuts and Tips FROM PS READERS

How we rigged a mower as a snow plow

My son and I have converted a rotary riding mower into a snow plow. It has served us well now through two winters and easily shifts back to mower use.

The plow blade is two thicknesses of galvanized metal formed into a concave shape over a ¾"-plywood frame. The blade assembly pivots on two wooden side arms bolted at the rear to the seat frame. The pivots permit the blade to pass over high spots or obstructions. Heavy springs at the top then pull it back into place. A wooden handle and a foot pedal allow me to raise the blade when I back out of a snow bank. Extra weight is carried on a platform behind the seat.

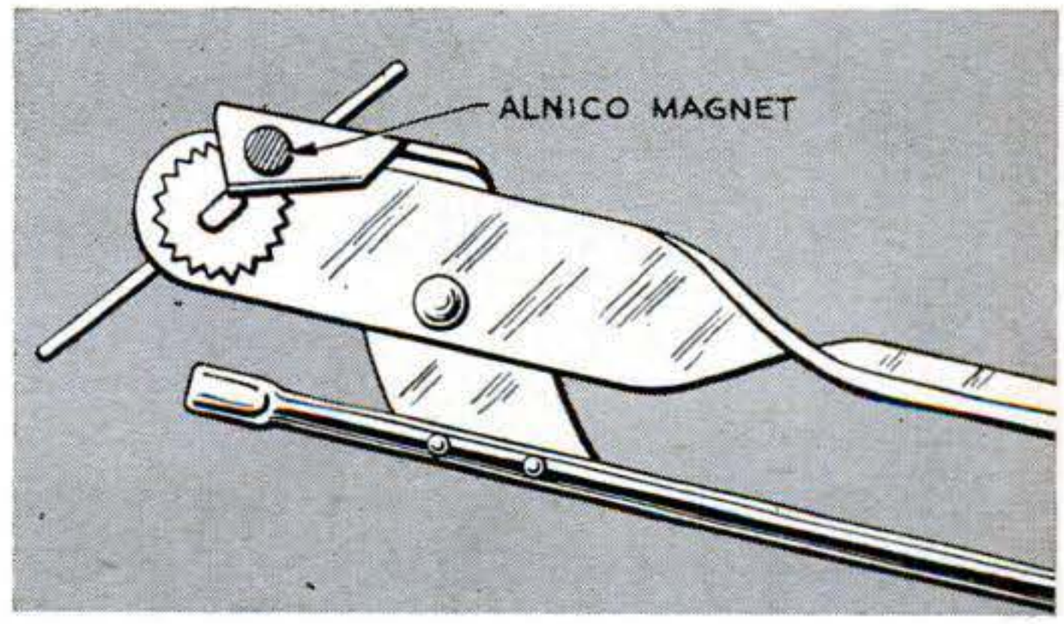
For plow use, the mower blade is turned upside down. It's needed as a flywheel for the engine. The photos show me and my daughter.—*Si Holcombe, Benton, Pa.*



Quick trick for a shower curtain

The plastic shower hooks that are now in wide use often interlock with each other when the shower cloth is pushed from side to side. They also tend to unhook.

I have a solution for both of these problems. Alternate the direction of successive hooks over the bar and through the eyelets. It works.—*Art Merrill, NYC.*



Magnet improves a hand can opener

When a small metal cutting showed up in a newly opened can of food I wondered how often this happens. For safety, I fastened a small Alnico magnet to our hand can opener, using one of the new two-solution epoxy cements. You'd be amazed at how many metal specks the magnet picks up.—*A. Weber, Edmonton, Can.*

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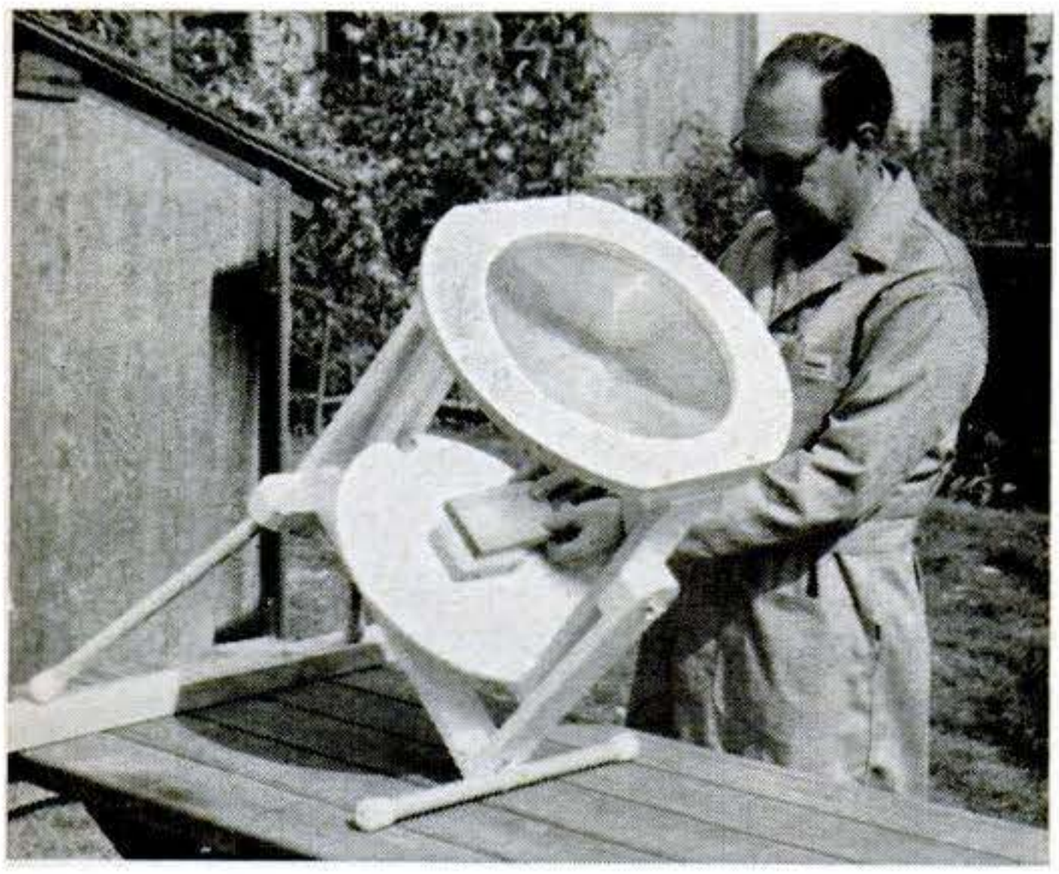
SHOP TALK By Sheldon M. Gallager

Anyone want to build a solar furnace?

An unusual plastic lens now makes it possible to build your own solar furnace at low cost. The 14″ lens, said to have the same light-focusing power of expensive glass lenses, comes in a kit sold for $6 by Edmund Scientific Co., Barrington, N. J. The kit includes plans for building an equatorial mount (left) and a 15-page booklet of experiments you can make. The lens generates temperatures up to 2,000 degrees—hot enough to braze metals.

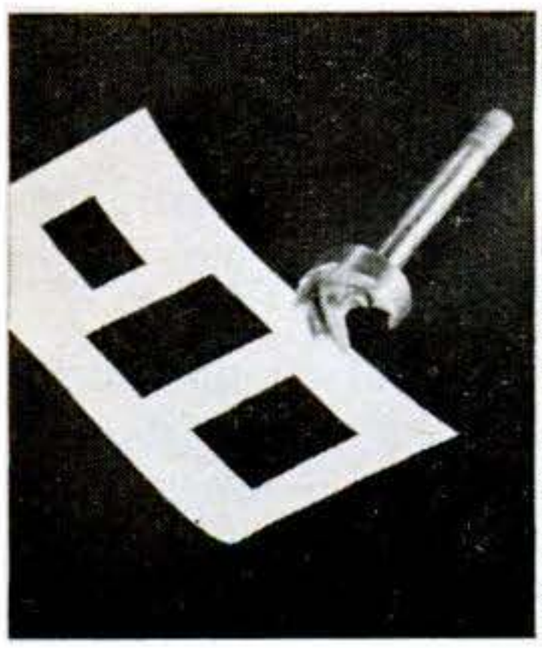


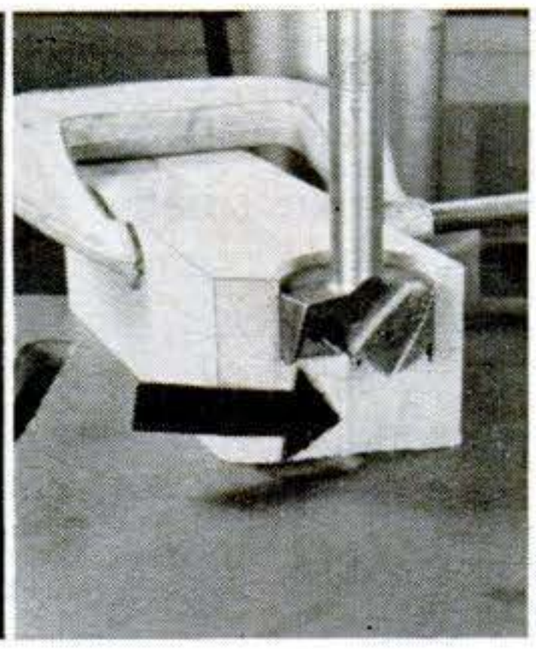
Never paint your house? Could be

The Du Pont people have come out with a tough, weatherproof plastic that's likely to show up soon on just about everything used outdoors. Called Tedlar, it's a thin polyvinyl fluoride film that can be bonded to almost any material, needs no painting, can't chip, peel, rot, or fade, and is expected to last 25 years. Actually, it may last even longer because it's been under test for 19 years and is still going strong. Already, manufacturers are hopping on the Tedlar bandwagon. U.S. Plywood is putting it on doors and wall panels, Ruberoid on roofs, Alsco on aluminum siding, Armco and Quaker State on gutters and downspouts, and—you name it, they're doing it. The ultimate: a completely Tedlar-wrapped house that's practically indestructible.

How do you drill a square hole with a round bit? Here's how

Woodworking expert R. J. De Cristoforo, well known to PS readers, passes along this trick for making precisely square holes in thin materials like sheet metal or flexible plastic. Fold the material in two, clamp it between two scrap blocks (arrow points to material), and bore a hole just off the centerline to a depth slightly less than half the bit's diameter. When you unfold the material, there's your square hole. Drilling deeper produces an oblong hole. On materials that can't be bent, such as wood veneer, drill through two pieces clamped side by side to make two half-holes. Then edge-glue the pieces.





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[Continued from page 75]

found that certain insects twittered in the morning, others at sundown, still others after a rain. He learned the average length of time between calls, how each species reacts to changes in the weather, time of day, the presence of predators.

More real than the real. With copious notes and thousands of tape snippings, he retired to the editing room, came out several months later with a carefully manufactured panorama of jungle sounds. The effect was so realistic that experts could hardly believe it hadn't been made in the jungle. Some years later, an expedition to the South American forests did make recordings. But the verdict was unanimous: They didn't give the same authentic jungle feeling.

It occurred to Asch that some people might like to buy the record, so he issued it under his Folkways label. Said Asch recently, "It's still one of my best sellers. After guys come home from a frantic day in the office, they put on the rain forest, lean back, and soothe their fevered brows."

The success of the rain-forest record sent Asch off and running on an ambitious project he had been thinking of for some time: documenting the sounds of the world and its peoples. So far he has issued some 700 records.

One of his most widely acclaimed projects is recording the folk music and ceremonies of the world's primitive peoples. His collection of several hundred records in this ethnic series has become a treasure trove for the world's anthropologists and lovers of folk music. Included are such never-before-heard gems as Songs of the African Bushmen—who speak a language full of clicks, whispers, and grunts.

City life, too. Asch has released a documentary, too, on the folkways of a slightly less obscure specimen: the native New Yorker in his asphalt habitat. Tony Schwartz, a free-lance recording specialist, strolled through sections of New York a few years ago with a portable recorder slung from one shoulder, edited the results into a disc called "New York 19" (the postal zone of the area he covered). Among the bits contained: strolling instrumentalists; pneumatic drills; a Times Square pitchman selling ball-point pens that will write in either English or Yiddish, prose or poetry; sirens; a plumber talking about music; and children singing and playing.

A few years earlier, Schwartz made another sound mosaic containing views on practically everything by that well-known philosophical wellspring: the New York taxidriver. Schwartz kept his tape running through seven years of taxi riding for this one, finally edited the more than 700 conversations into one record.

Schwartz, who spends most of his time putting sound on tape and organizing the sound into meaningful patterns, thinks the day when phonograph records automatically mean music to most people is rapidly drawing to a close. "In the future," he says, "music will end up as small a percentage of recordings as it is of life."

Whether Schwartz's prediction turns out to be right or wrong, there is little doubt that the advent of the small, light, high-quality tape recorder has revolutionized the recording world. With today's machines, explorers can record the sounds of life on a mountaintop, in jungles, or in swamps, and while running, walking, riding, or parachute jumping.

With the variety of sounds and experiences they offer today's record buyer, makers of nonmusical recordings keep sales galloping—in some cases, into trouble.

For the birds. A few years ago, Perry Wrightman of Easton, Md., recorded the sounds of ducks and geese contentedly feeding and making all the noises that contented ducks and geese make. Then he designed a small portable playback unit easily carried into the blind.

Conservation societies have been up in arms ever since, and have had the device banned in most states. The reason: It's brutally effective. It attracts flying geese up to a quarter-mile away. According to the Maryland Fish and Wildlife Department, hunters in four shooting pits slaughtered 1,285 geese in short order.

With duck and geese decoy records outlawed, the only records Wrightman's company sells are calls of pests.

Most sound hunters don't run into trouble with the law: Their difficulties are more down to earth. Barrett Clark of Riverside Records went to Mexico to capture on vinylite the authentic sounds of the bullfight. To get close-up realism, he buried the microphone under a thin covering of dirt out in the ring. Everything was fine until the bull stomped on the mike. ■ ■

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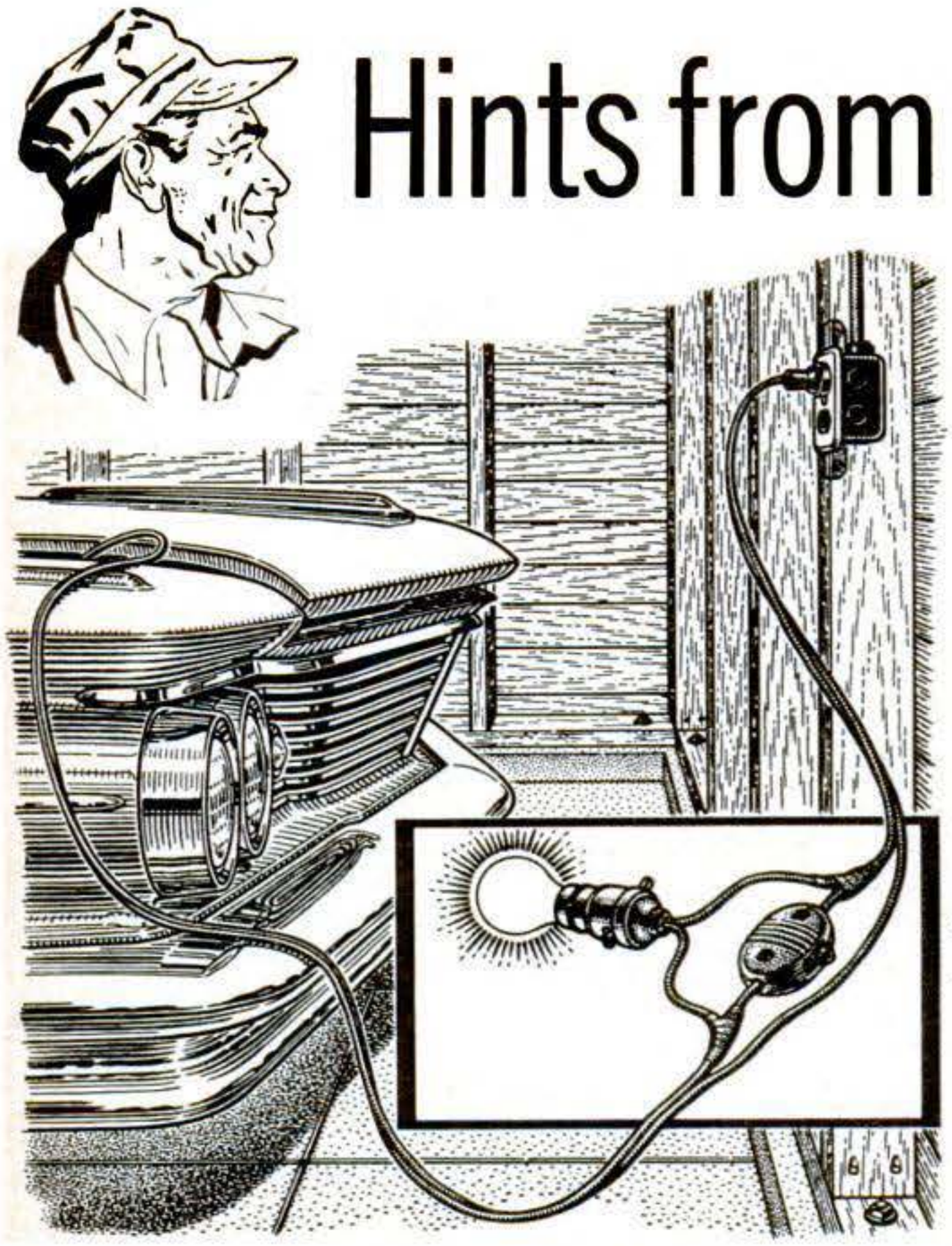
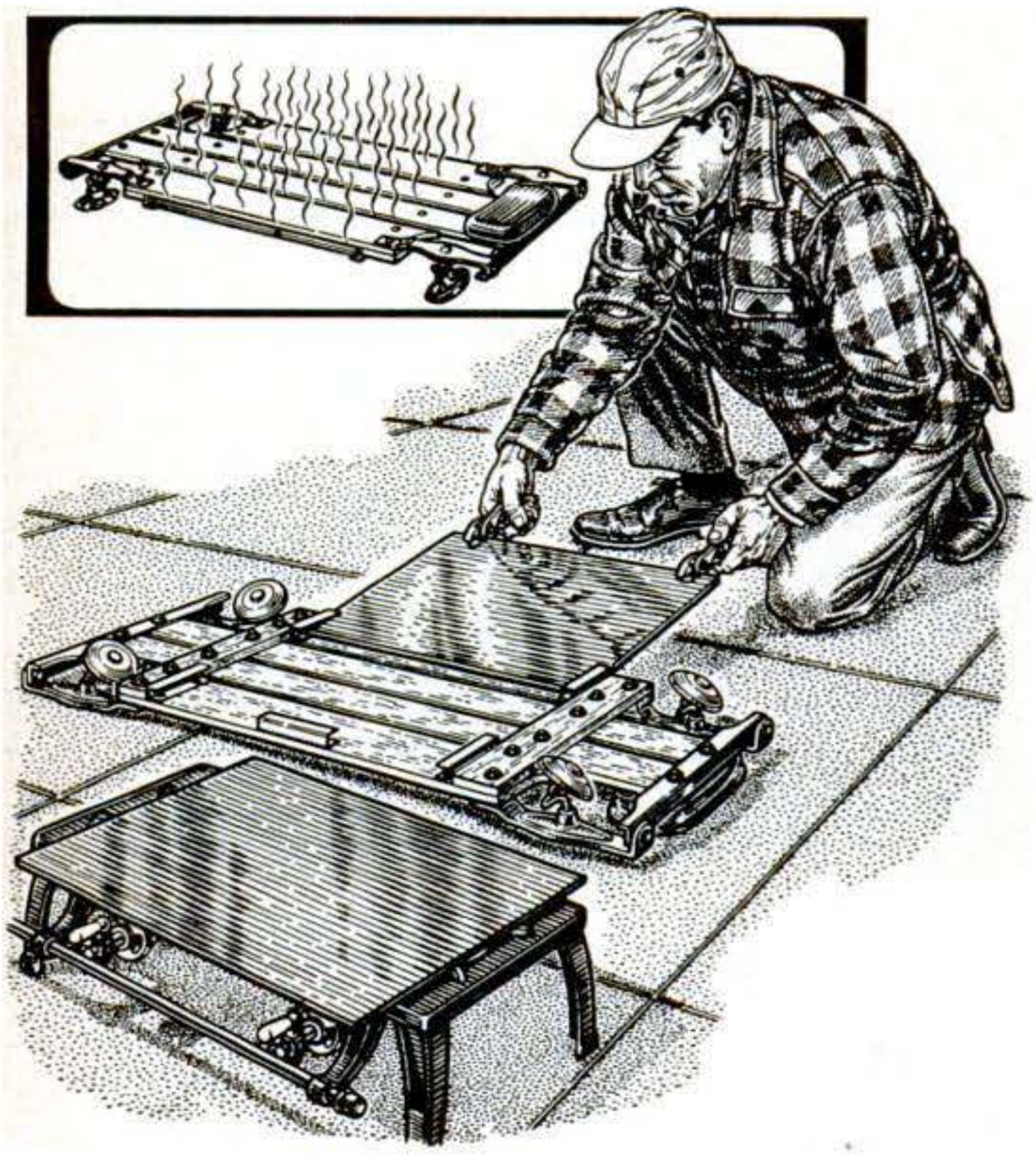
Hints from the Model Garage

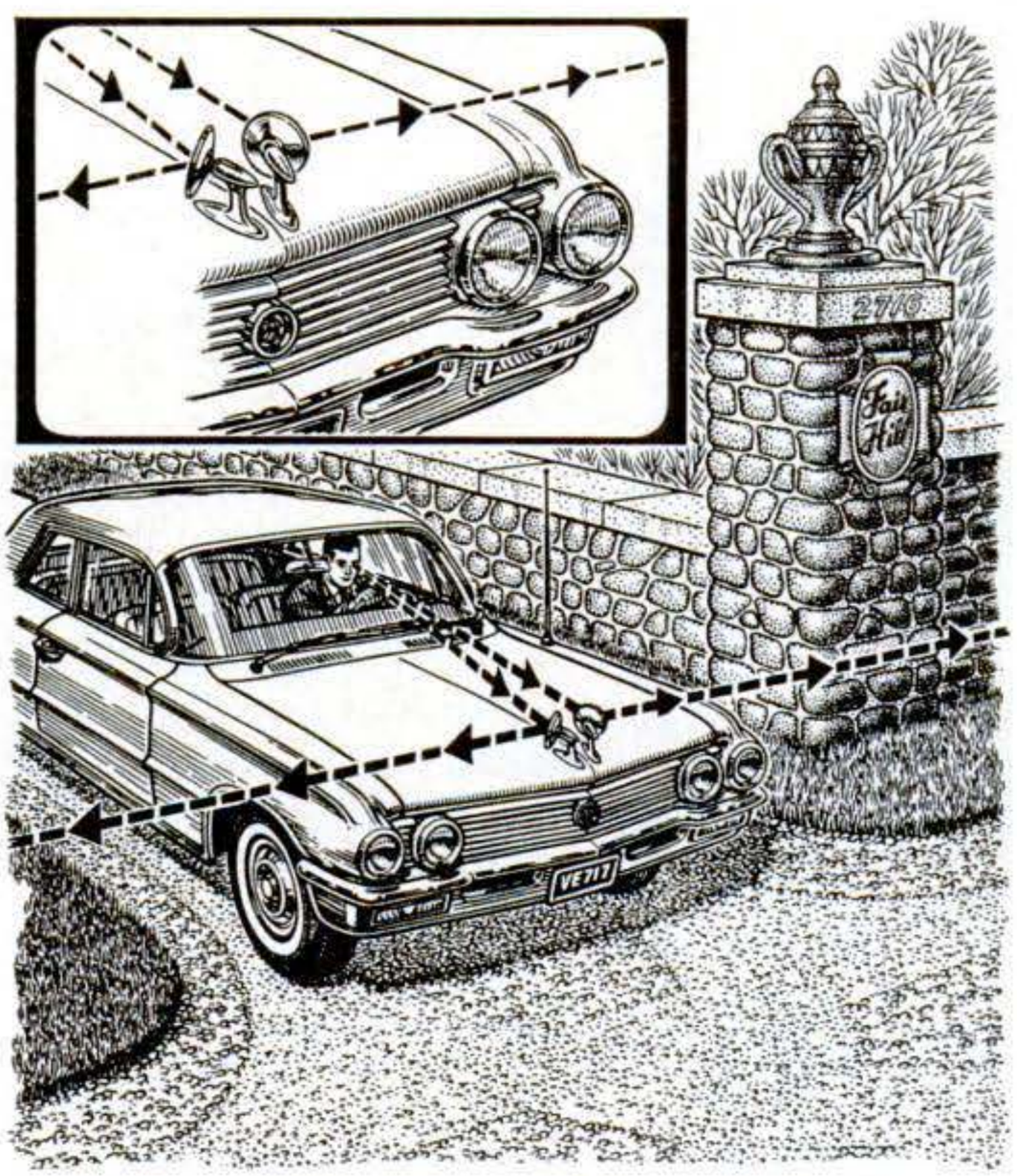


To be sure your block heater is working, wire in a bulb and a normally closed push-button switch as shown, with the bulb connected in series with the heating element. To test, open the switch. If the bulb lights, the heater is drawing current.

Your seat belt is always within reach when you secure the short end with this holder. Cement a small magnet to a ½"-by-4" steel upright. The right-angle bend in the upright holds it snugly between seat frame and cushion. Bolt it if necessary.



A warm creeper is welcome on a cold day when you make repairs outdoors. Heat a piece of 18"-by-30" boiler plate on a garage stove; it'll stay hot several minutes. U brackets hold it under the creeper. Keep a second plate heating on the stove.



To see into blind intersections without pulling out dangerously far, try these two small hood-mounted mirrors. Most mirrors have a limited range of adjustment, so toe them in 25 degrees. On bare late-model hoods, the mirrors double as ornaments.

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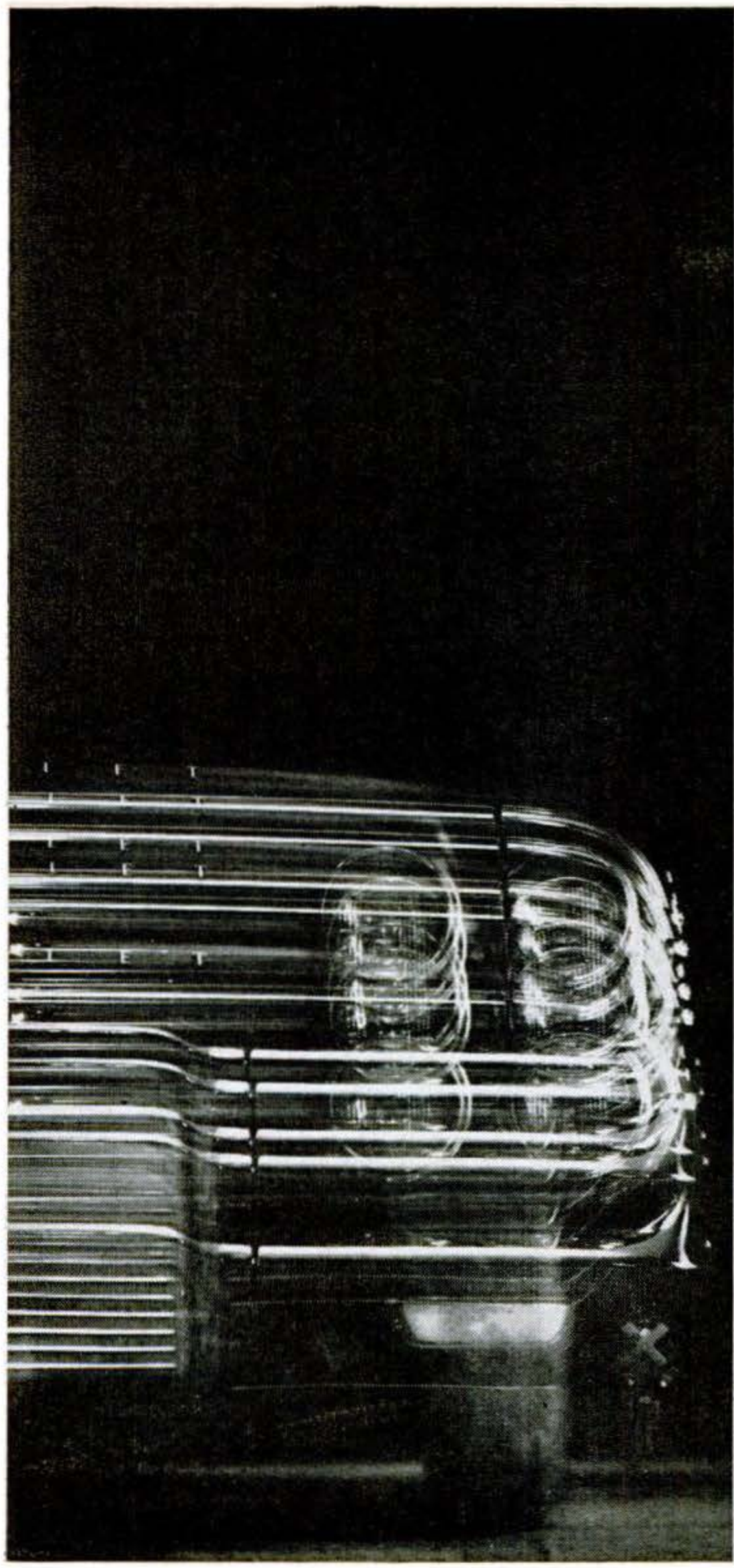

ride

smoother

When you want your Chevrolet to ride like new, ask for GENUINE CHEVROLET REPLACEMENT PARTS

Actually, if you know the symptoms, it's easy to tell when a shock absorber is worn out: The ride becomes jolty and bouncy; there's noticeable front-end "dive" during stops; and the braking is uneven. Prescription: genuine GM Chevrolet replacement shocks—quality-built especially to fit right and work right in Chevrolets. They're available at your Chevrolet dealer's and leading independent garages and service stations everywhere. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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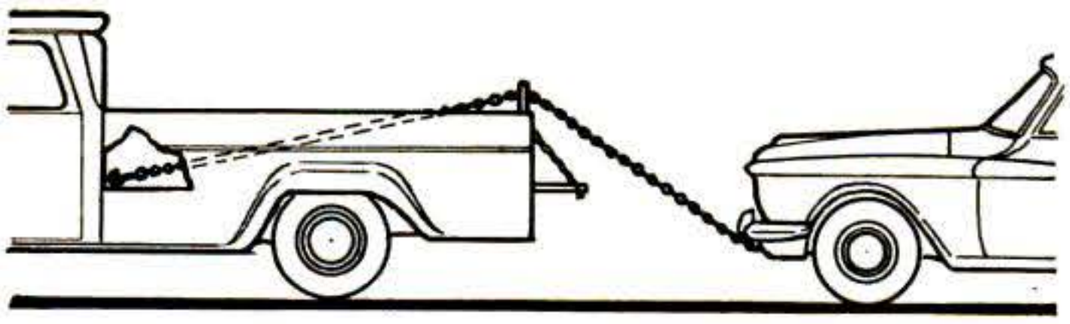
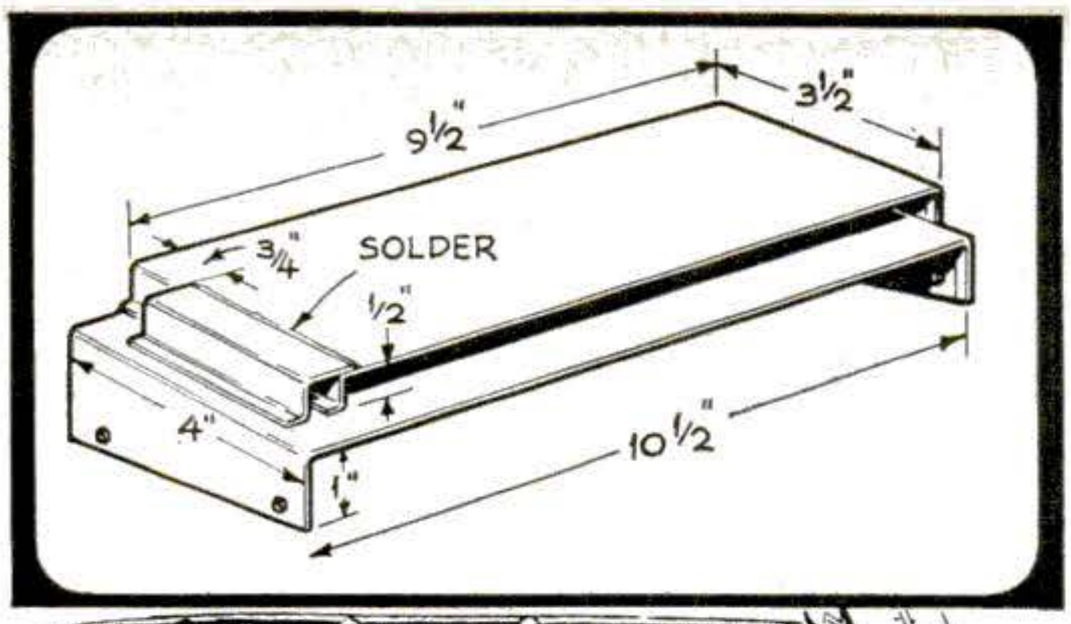
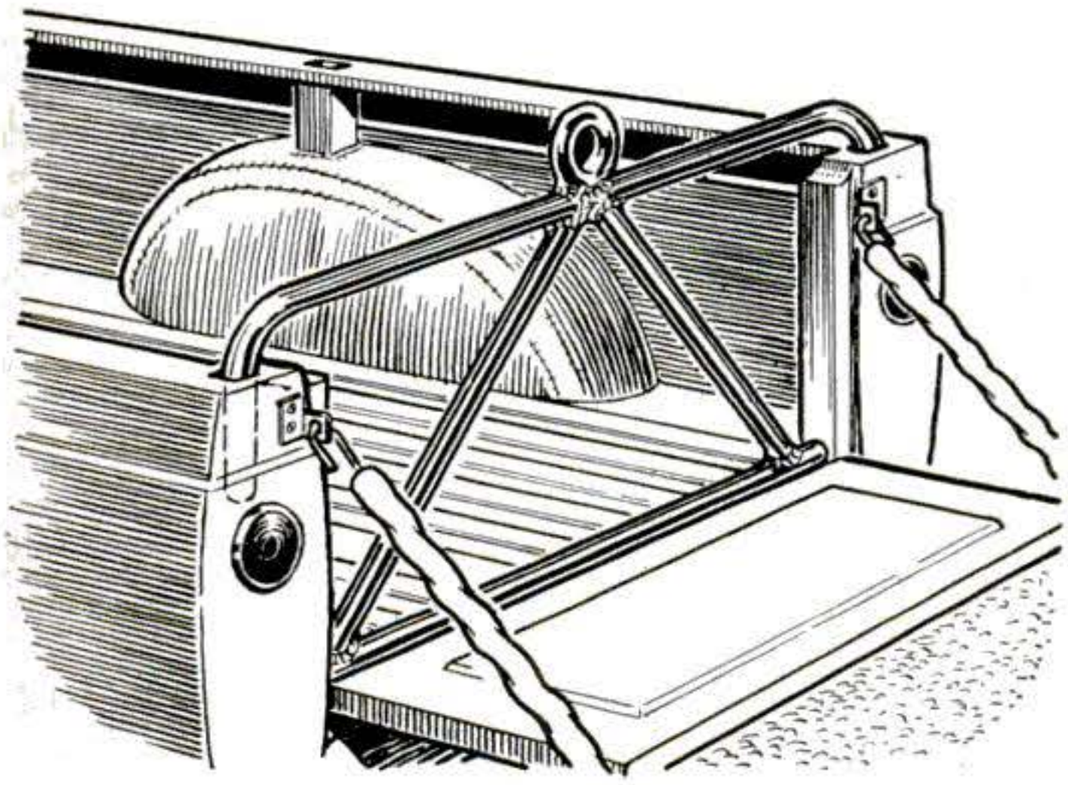
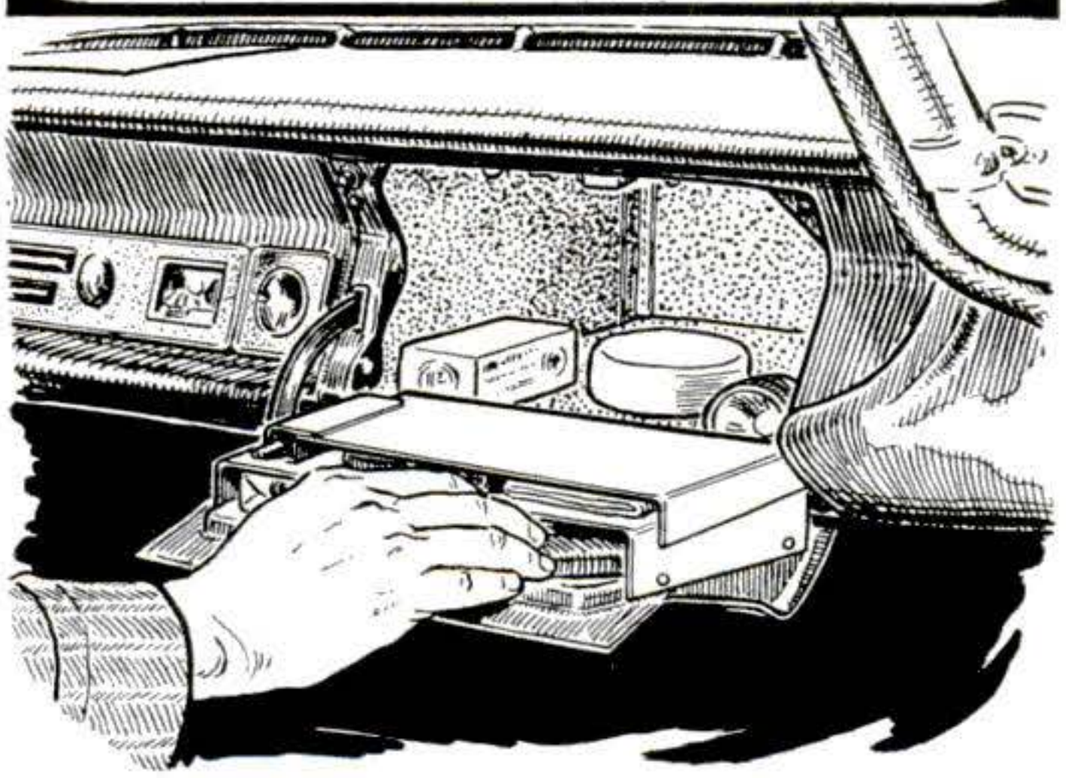
More Hints from the Model Garage



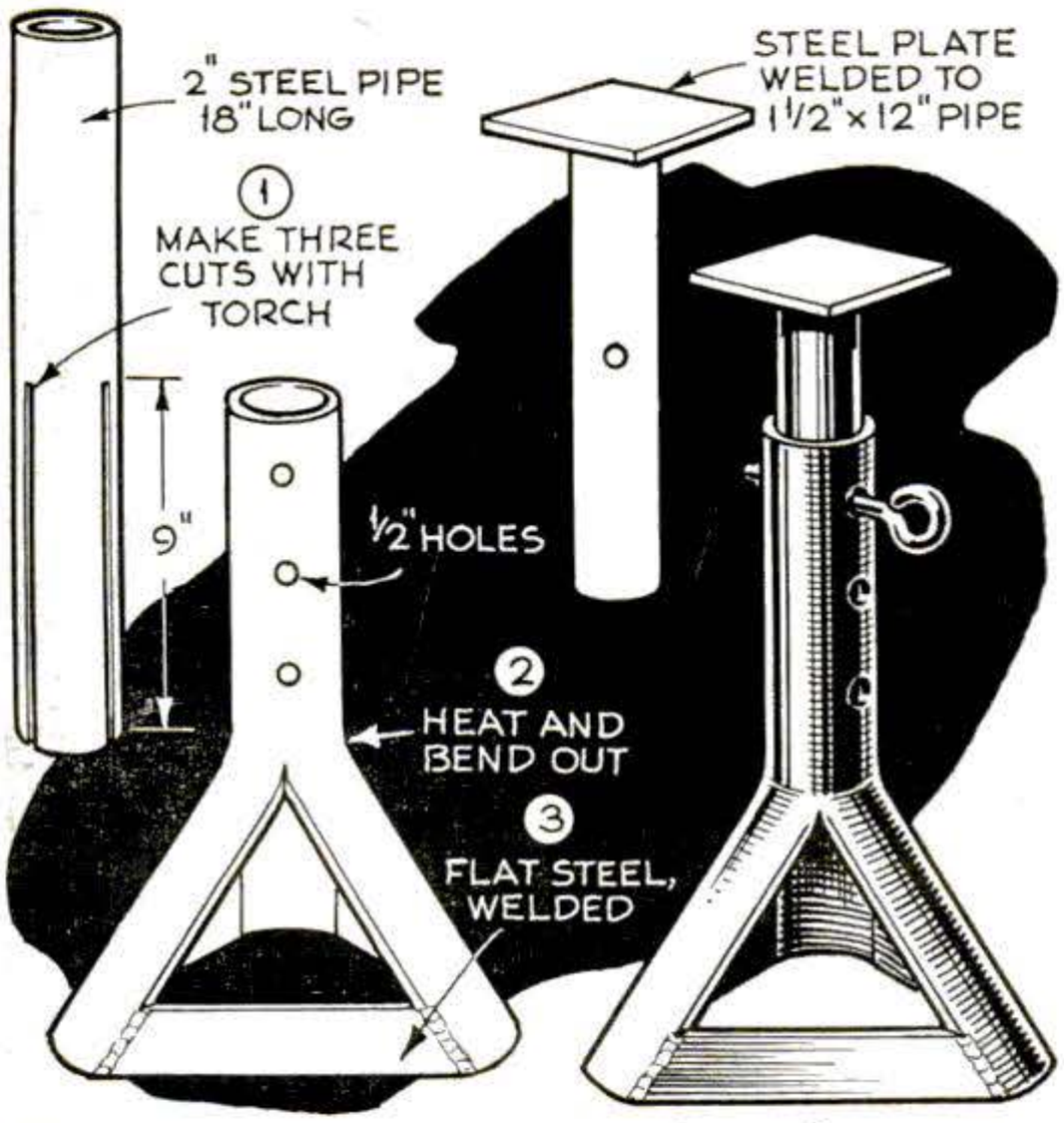




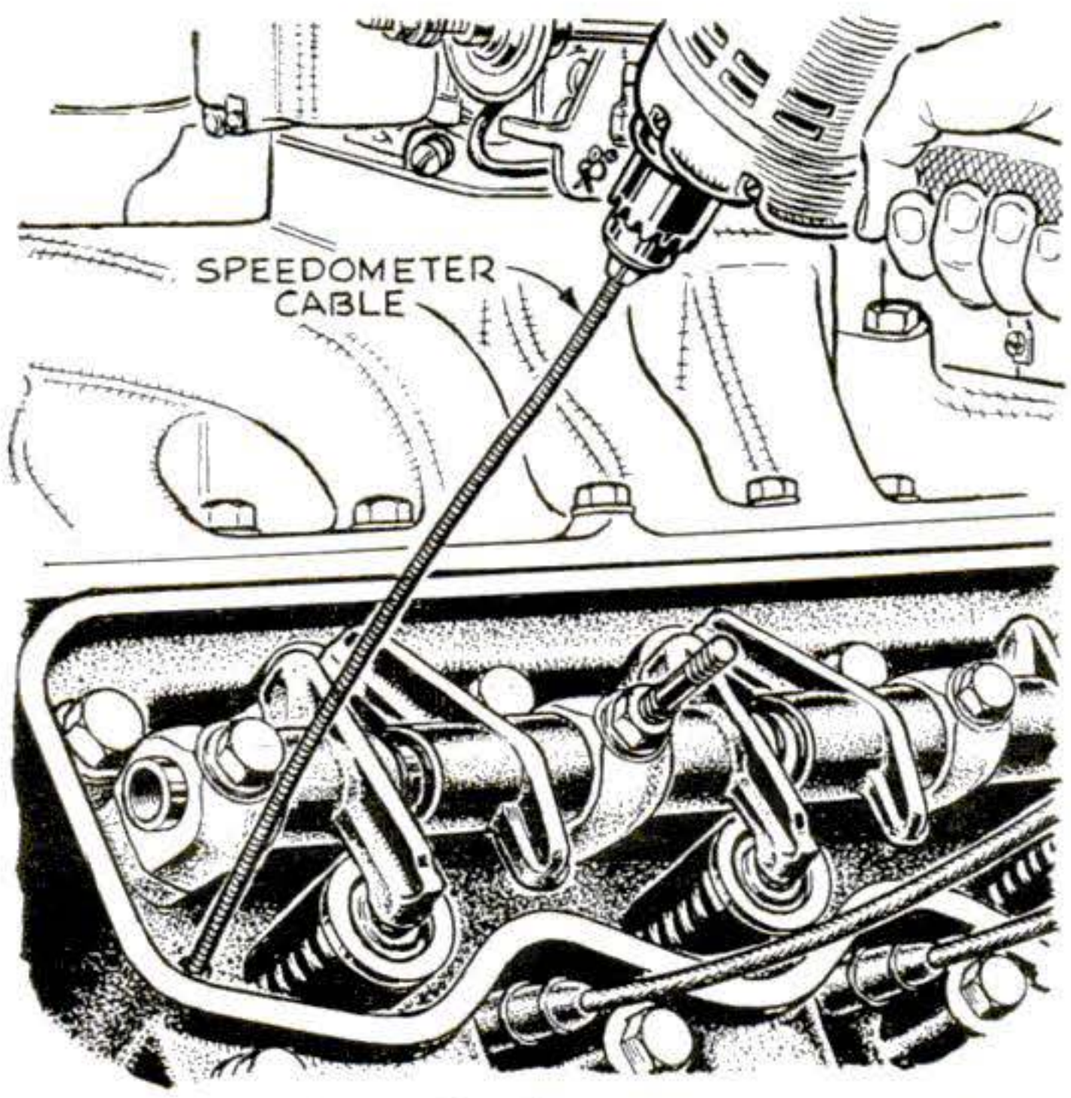
You can improve traction of a two-wheel-drive tow truck with a welded tubular framework that raises the tow line at the rear. This also allows the truck springs to cushion the pull. Weld a ring to the top of the frame to guide the tow line.



To keep your glove box neat, make this dual-compartment container from sheet copper and mount it on the inside of the lid. Roll the front edges for safety. The dimensions given are for 1958-62 Ramblers, but they can be changed to fit other cars.



Car supports are easy to make with 2″ pipe. Cut three slits with a torch, heat, and bend strips out to form a tripod. Brace with flat steel. A piece of 1½″ pipe with a platform welded on is adjusted with a ½″ pin inserted through one of three holes.



Clean out clogged oil-return ports in OHV engines with a piece of discarded speedometer cable inserted in a power drill. The digging action often does the job where air pressure fails. Don't press too hard, or the cable may kink and fray.

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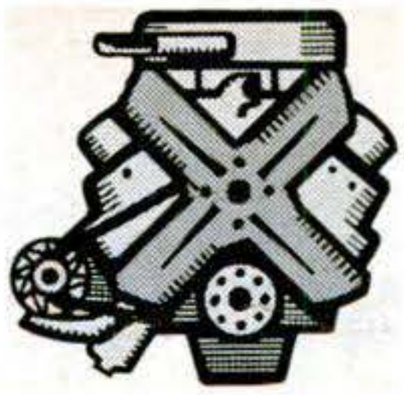
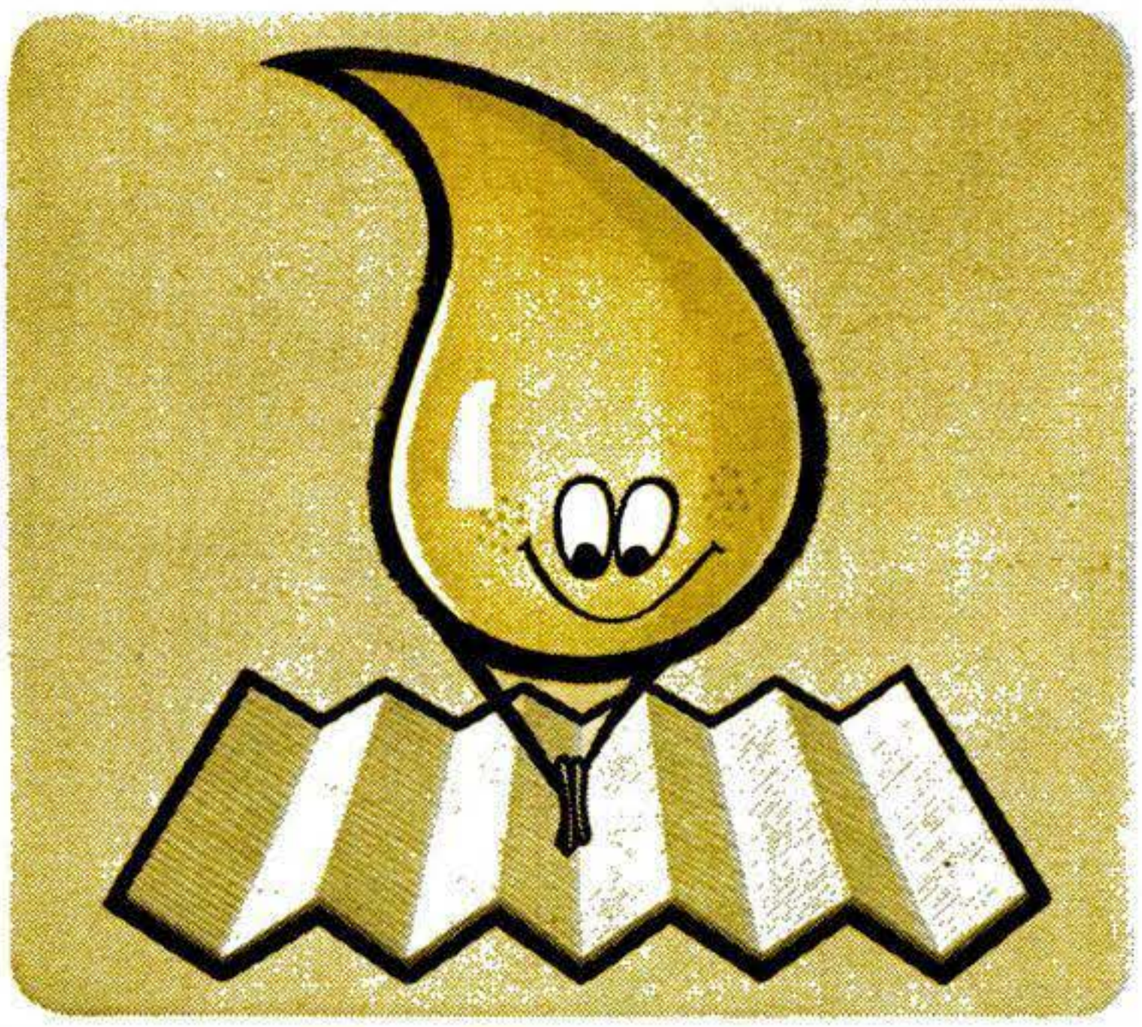
HELP YOUR ENGINE  ENJOY LONGER LIFE



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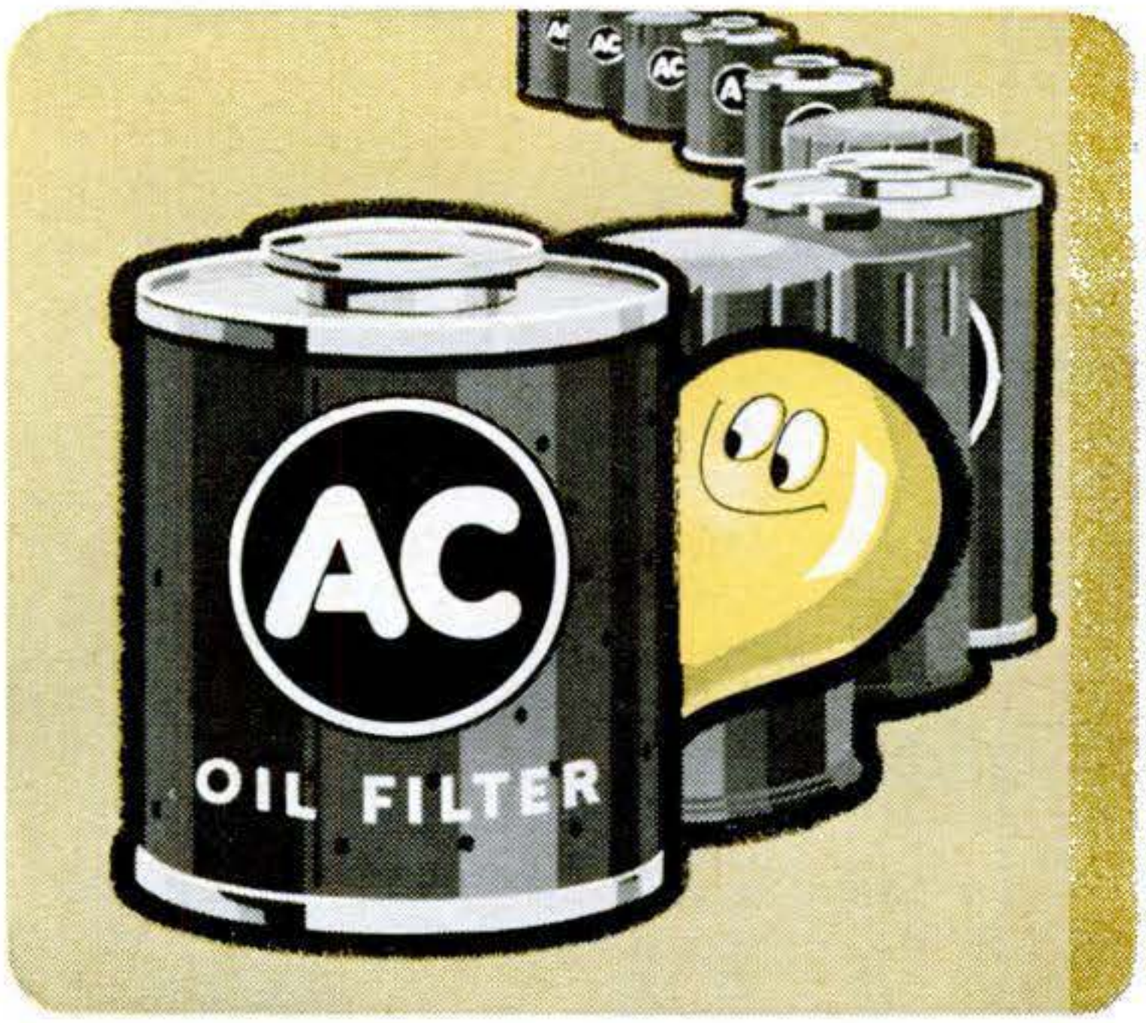
There is an AC Filter specifically designed to fit each car on the road. There's one specially engineered for your car.



The next time you change your oil, change the filter, too. Help your engine enjoy longer life the right way with an AC Oil Filter.

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Gus Goes Gunning for Business

By Martin Bunn

"STAN," Gus Wilson called. "Stan," he called again, louder this time. "What are you doing out there?"

Stan Hicks appeared at the door of the Model Garage office. He carried a large book under his arm. "Just reading the new shop manuals, Boss. A good mechanic has to keep himself informed these days. Something you want?" he asked.

"You'll have to take care of things this afternoon," said Gus. "There's not much doing anyway. I'm going to run over to see Jerry Otis about that fleet-service contract I've been angling for."

"That ought to be a good thing, if you can bid it right," said Stan. "There must be 20 or 30 cars in that fleet."

"It'll take more than a low bid to get the business," Gus said. "Otis is a stickler for having his salesmen's cars in top shape. His firm lost a big order to a competitor a year or so ago because a company car broke down and made a salesman late for an appointment. Otis never forgot it."

Stan shook his head. "That was an expensive breakdown."

"Sure was," Gus agreed, "but not in terms of what it cost to repair the car. In fact, if I recall correctly, Mike Harris at the Highway Gas Station happened by and fixed the trouble on the spot with a piece of string."

"You're kidding," said Stan. "What could you fix on a car with string?"

"The primary lead to the coil rubbed against the cylinder head, and the insulation had chafed away," Gus explained.

"And of course it shorted out just when the car was needed most," Stan put in.

"Doesn't it always happen that way?" Gus chuckled. "Anyway," he continued, "Mike used the string to suspend the exposed wire away from the engine, and the salesman raced off to keep his overdue appointment."

"And met the other salesman coming out of the plant," Stan ventured.

"That's right, and he was grinning like a Cheshire cat." Gus rose and reached for his jacket. "So you can see that I've got to sell Otis on the dependability of our work, not on how little it'll cost him.

"Be back late this afternoon," he called as the door closed.

Gus hadn't been gone more than half an hour when a car drove into the shop. It sounded as if someone had put a cage of canaries under the hood, with all of them chirping at once.

Stan looked up over the shop manual he had been reading, and swallowed hard as he recognized the driver. It was Jerry Otis, the man Gus had gone to see.

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Gus stopped short as Stan gestured wildly and pointed to the man in the office.

Otis flung open the door and stepped out of the car. He glared at Stan. "Is this a repair shop or the public library?"

Stan jumped up, dropping the manual. "Sorry, sir. What can I do for you?" Then, seizing his chance to show off: "Been reading up on those new electronic distributors. Great gadgets. Last the life of the car, you know."

Otis ignored Stan's display of knowledge. "What do you mean, what can you do for me? Can't you hear that engine?"

Stan, deflated somewhat, continued trying to impress Otis. "Sounds to me like squeaky rocker arms. They're not getting any oil. Here, let me show you. I'll have the covers off in a minute."

He walked over to the car, raised the hood, unscrewed two nuts, and pried one of the sheet-metal covers off its cylinder head. The noise became louder.

"That's the trouble, all right. Spotted it the minute you came in," Stan said, beaming with self-pride.

Otis was obviously growing impatient. "All right, Doctor Crankcase, but how long will it take you to fix it? I'm in a hurry. Can you do it while I wait? I need the car."

Stan smiled patiently, irritating Otis even more. "Not unless you want to wait here until tomorrow. Those oil lines are clogged with sludge. We'll have to take off the cylinder heads on both sides and dismantle the rocker-arm assemblies in order to clear the passages. Should be ready by tomorrow afternoon, though."

"That's what they told me at the car dealer's service department, so I came over here to see if Gus Wilson could do one of those mechanical miracles I've heard he performs. You're not Wilson?"

"No, sir," said Stan.

CONTINUED

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Otis looked around angrily. "Where is he, anyway?"

Stan hesitated, decided not to tell Otis that Gus probably was waiting for him at his office. "Mr. Wilson had some business to attend to. He should be back later this afternoon."

"*Mr.* Wilson!" Otis exclaimed. He peered into the office. "Who runs this place, or is it always like this?"

"Oh, Mr. Wilson is the boss," Stan replied. "I'm his chief mechanic."

"Well, I can't wait around all afternoon," Otis complained. "If I can use your phone, I'll call a taxi to take me back to the office. But you tell Wilson that I don't care if he has to work all night, and I don't care how much it costs, I must have this car running quietly first thing in the morning—and I don't mean 10 o'clock."

Otis picked up the phone. He had barely finished dialing when Gus walked into the shop.

"Couldn't get to see Otis, Stan. His secretary told me he dashed out early on some urgent bus . . ." Gus stopped short as Stan gestured wildly and pointed to the office, his face screwed up as though in pain.

Otis came into the garage at that moment. "Stop dancing around, young man," he told Stan.

He turned cold eyes on Gus. "So you're Wilson. I suppose you were over at the plant trying to sell me on giving you the fleet-service contract I've advertised. Well, just forget that contract, at least for the present."

He moved closer to Gus and spoke low, "Listen, Wilson, I'm in a spot. The president of the company is coming out from the main office tomorrow, and he expects a guided tour of the plant and the community around it. As general purchasing agent, it's part of my job to keep the cars our sales and service people use in perfect condition. Now, how's it going to look if I have to drive him around in this squeaker? I've been intending to have it checked, but I don't put much mileage on it, just short runs, so I keep putting it off. Isn't there something you can do? I can't drive a VIP around in a calliope!"

Gus walked to the car. "Hmm, dry as a bone," he said, looking at the uncovered rocker-arm assembly. "Stan," he called to his assistant, "bring over the grease gun."

"Are you crazy, Wilson?" Otis demanded. "I'm no mechanic, but any fool knows you don't grease an engine."

"Mr. Otis," Gus replied softly, "I'm trying to help you. But it's getting late and we'll be here all night if I have to explain every move I make. Why don't you sit down and let me get on with the job?"

CONTINUED

The dodge that saved the day

Two college boys were on their way across a lake one warm spring evening in a borrowed motorboat of ancient vintage. They were dressed for a party—something special.

Almost from the dock, the old engine started to heat up. Then it began to slow down. They shut it off and made a hurried inspection. The dip stick was dry; not a drop of oil on it. There was no extra oil aboard. Running the engine further would surely ruin the borrowed craft—and perhaps it wouldn't even get them back to shore, much less to the far side of the lake where the party was about to begin.

What to do?

Because of the age of the engine, one of the boys reasoned that it might be of the wet-base type where lubrication is done by the splashing of the crankshaft in the oil pan. If the oil level could be raised an inch or so, he figured, engine lubrication could begin again.

Fortunately there was a bucket aboard. Filling it with water from over the side, he then improvised a funnel from some newspapers he found under a seat. He poured two quarts of water down the oil-filler pipe. Since oil floats on water, this raised the oil level to a point where it could be reached by the crankshaft. With lubrication again, they were able to continue across the lake, with the engine working nicely.

P.S. The boys not only made the party on time, and had themselves a ball, but were able to go back home across the lake using the same oil-raising dodge.

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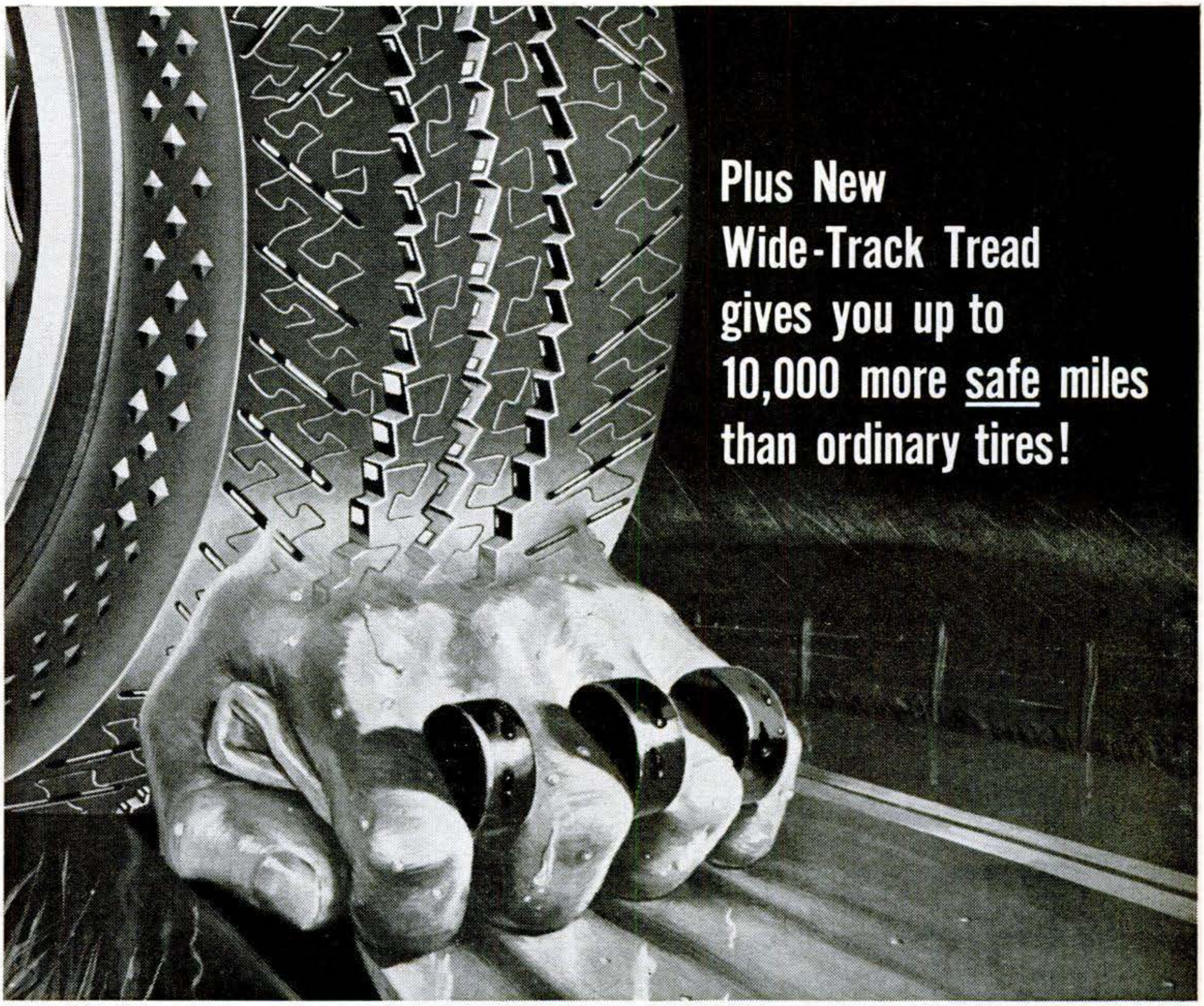
with "Ounce of Prevention" Safety Discs!



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You can't buy a better tire . . . to save your life . . . than ARMSTRONG!

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Otis moved back a step. "Sorry, Wilson. Go ahead and do whatever you think you have to do."

Stan brought the grease gun from the bench. He, too, looked puzzled.

"Scoop the grease out of the barrel and pump the handle until the pressure chamber is empty," Gus said. "Then fill the gun with heavy oil—number 50."

Stan went to the bench, shaking his head. By the time he had returned with the oil-filled grease gun, Gus had uncovered the oil passage on each side of the engine, and had enlarged and tapped the holes to receive grease fittings.

Gus, a twinkle in his eye, told Stan, "Here's one you won't find in the shop manuals. Watch this."

He pressed the nozzle of the gun on one of the grease fittings and pumped the handle vigorously until the gun was empty. Then he went to the bench, refilled the gun with oil, and pumped it into the grease fitting on the opposite side. He handed the empty gun to Stan and bent over the engine to remove the grease fittings and reset the rocker shafts. Finally, he straightened with a smile of satisfaction and turned to Stan.

"That should do it," he said. "Start the engine up, Stan, and let's see if the birds fly away."

Stan winked knowingly at Gus. "I get it. What goes down should come up, eh?" He turned the key and the engine roared to life—squeaking as loudly as it had when Otis brought it in.

Stan and Otis both turned to Gus as though awaiting an explanation for this apparent failure. Gus said nothing. He stood quietly watching the engine.

A minute passed. It seemed like an hour. Then, slowly, one by one, the chirping rocker arms quieted.

In two more minutes the engine was purring silently except for the light, normal clicking of the tappets.

Stan shouted, "Look, the oil's circulating. See it running toward the return passages, Gus?"

Otis slapped Gus vigorously on the shoulder. "Wilson, you're everything I've been hearing about you. But what was all that business with the grease gun and the oil?"

Gus grinned. "Just a practical example of the irresistible force being applied to the immovable object."

"Come again?" asked Otis, raising his left eyebrow.

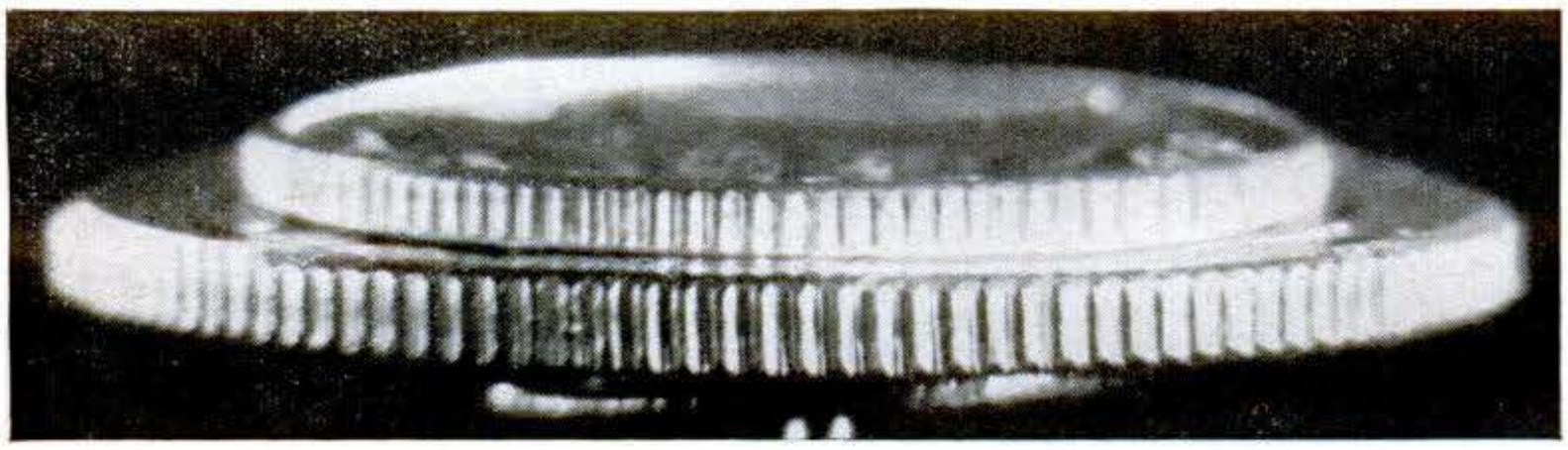
Gus continued with the lesson. "Those oil lines were plugged solid with sludge. On this make car, the passages don't run straight enough to clear them by rodding, so I applied about 10,000 pounds of hydraulic pressure to the obstruction and blew the lines clear. The grease gun supplied the pressure, and when I emptied the gun I knew the lines were open."

"That's good thinking, Wilson. But what caused all that sludge?" Otis asked. "This car's been driven so little it's practically new."

"That's just the trouble," Gus said. "Most folks don't realize that condensation is heaviest on short runs because the engine doesn't get hot enough to evaporate the moisture produced by burning fuel. When the moisture mixes with oil, thick sludge forms. I'd suggest you have your oil and filter changed the first chance you get, and remember to change the oil more often in the future."

Otis beamed. "I'll let you do my worrying from now on, Gus. Your irresistible force has moved me into offering you our service work. How about it?"

Before Gus could reply, a loud squeaking noise filled the shop. Both men turned with a start in time to see Stan pushing a dolly across the floor. He grinned sheepishly. "I've been intending to oil these casters. No sense putting it off. It's about time I got *these* birds to fly away." ■ ■



What's this a photo of?

ANSWER: No, not cogs or gears. They are side views of a dime and a quarter, showing the coins' milled edges.

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America's only v-6 (it steals everybody's thunder)

Buick Special, last year's runaway popular success, is headed for even greater acclaim in '63, and for good reasons. Most obvious: its V-6 engine . . . nimble action with regular gas economy (more details below). Other reasons: Special silk-smooth transmission response. A low price. High trade-in value. Plenty of no-cost extras, such as rugged aluminized muffler, 6,000-mile lubed front suspension, new Delcotron generator. Plus: Special luxury and room (Stretch out, everybody. All Specials, V-6 or aluminum V-8, are *happy medium-size!*). See for yourself, soon. Get happy . . . go Special!

'63 buick special

The prize winning V-6: Engine weight from 140-179 lbs. less than in-line sixes . . . this lightness means greater gas savings. Crankshaft is shorter, more rigid, yields smoother operation. 90° engine configuration means greater engine rigidity . . . longer engine life. Performance: Torque output closely follows power curve of V-8. Performance characteristics markedly superior to competing in-line sixes. Carburetion: 2-bbl. carb. works one barrel for each 3 cylinder-bank. (More evenly balanced fuel distribution; no problem of one cylinder getting a richer mixture of gasoline than any other.) Suction, exhaust strokes evenly spaced in each bank, for better breathing, excellent exhaust-gas scavenging.

ALSO NEW FROM BUICK MOTOR DIVISION: BUICK LESABRE/WILDCAT/SKYLARK/ELECTRA 225/RIVIERA

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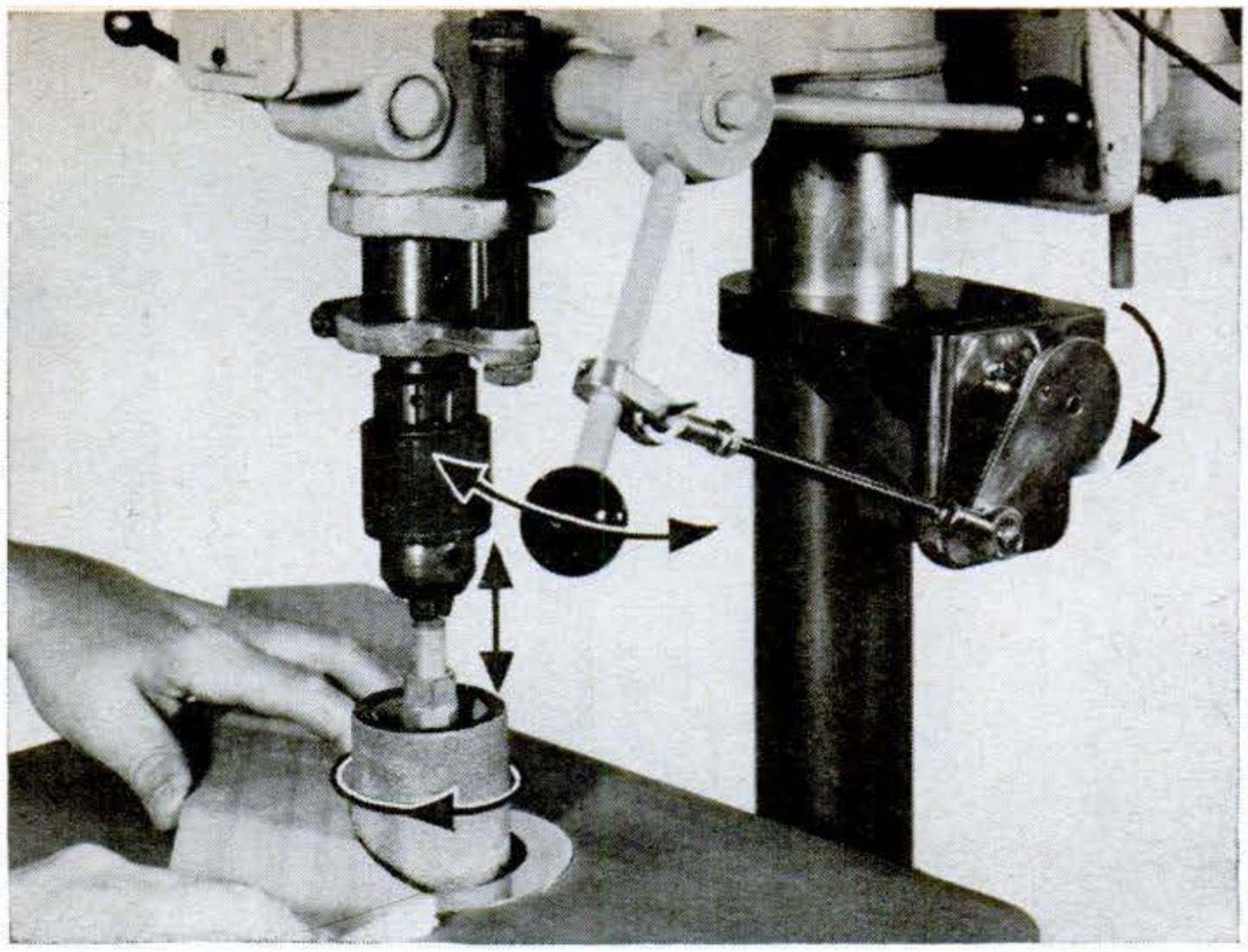
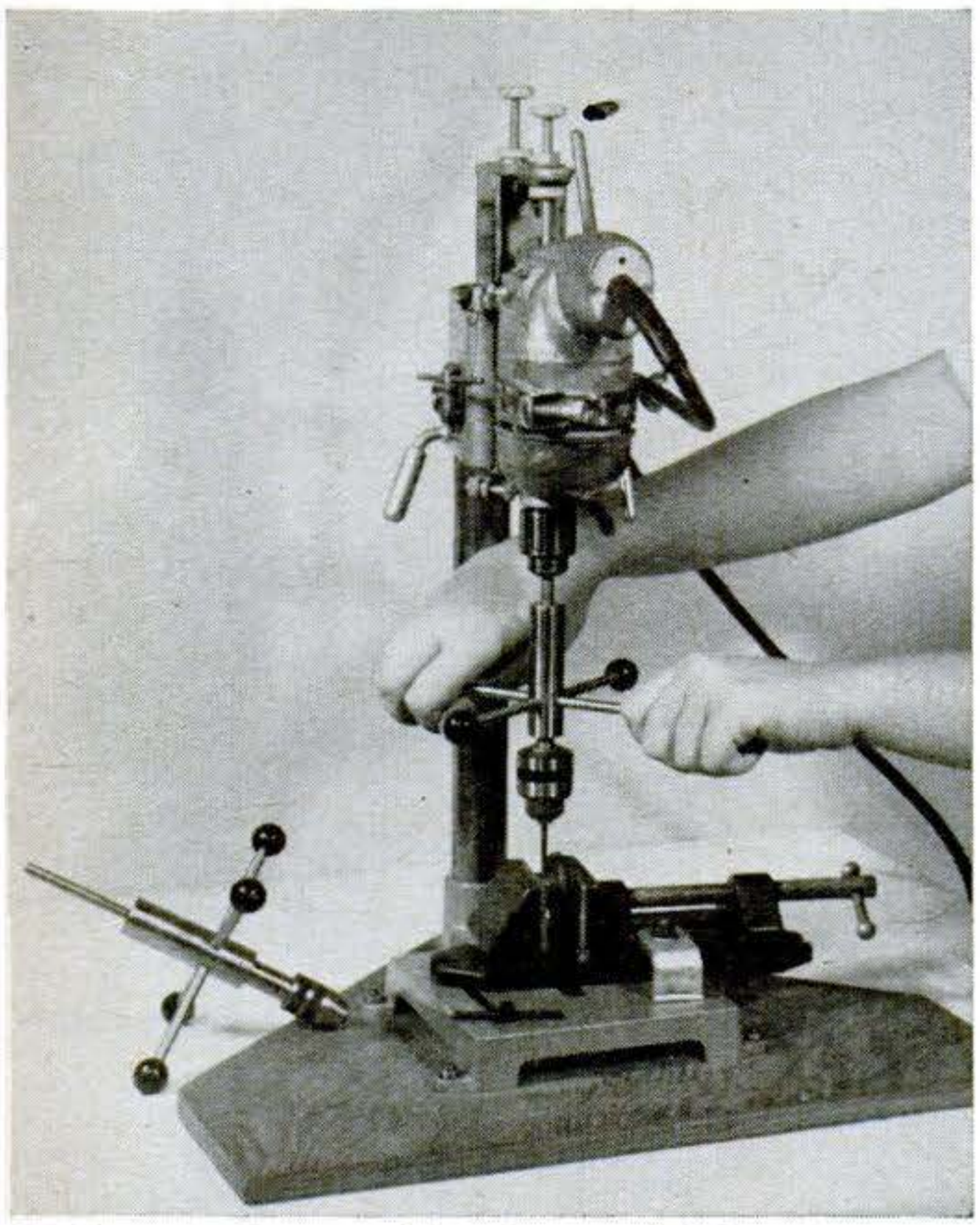
This Sanding Drum Also Oscillates



You can make a sanding drum move up and down as it spins. You do it with a new kit for home-shop drill presses. The oscillating action, normally found only on expensive industrial machines, sands much faster and more smoothly; it also lengthens drum life. A 30-r.p.m. motor clamped to the column turns a crank connected by a rod to one quill-feed handle. As the crank rotates, it moves the handle back and forth, raising and lowering the drum 30 times a minute. The kit includes motor, hub, bearings, and instructions for making the other parts yourself. Price is $11.85, J & B Products, Box 5508, Sherman Oaks, Calif.

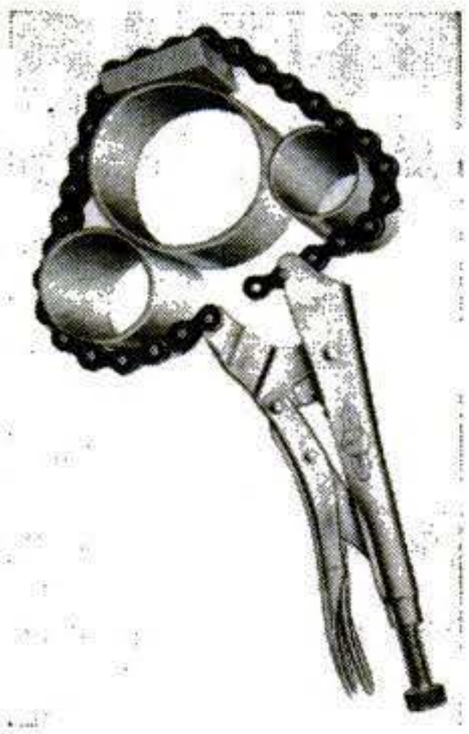


Hole-tapping guide for a drill press

This tapping guide lets you thread holes accurately with the aid of a drill press or stand-mounted portable drill. The tap is chucked in the guide, and the guide, in turn, is chucked in the drill to align the tap as you turn it. Four handles make it easy to turn the tap smoothly. $9.95, Ethical Enterprises, Somerville, N. J.

Chain pliers work as wrench or clamp

The familiar Vise-Grip cam-action pliers now come in a new version. Instead of conventional jaws, this one has a chain similar to that on a chain-type pipe wrench. The adjustable chain is first fastened around an object; then the handle is squeezed to draw the chain up tight. The tool can be used either as a wrench or as a clamp to hold odd-shaped work. $5.95, Petersen Mfg. Co., DeWitt, Nebr.



Dispenser pumps oil from any quart can

Any standard quart oil can becomes a pump-type oiler with this dispenser. You simply pierce the can lid with the stem and press the trigger to pump oil out. $3.95, MGM Industries, Box 367, Cushing, Okla.

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PHOTOGRAPHICALLY SPEAKING

By Bob Hering PS PHOTO EDITOR

Now there's a faster Kodachrome

It's hard to improve on a good product like Kodachrome—but Eastman Kodak has done it for the second time within two years. First it was Kodachrome II which upped its speed over the old Kodachrome by 2½ times. Now, to give the average camera buff better shooting, Eastman has come up with a brand-new film called Kodachrome X. It doesn't replace Kodachrome II, but it does give us some of the things we wanted.

For one thing, there's plenty of speed. Kodachrome X, with an ASA of 64, is 2½ times faster than Kodachrome II. When you compare the Kodachromes: Kodachrome X has a slightly higher contrast than Kodachrome II, though not so much as the original Kodachrome. Colors reproduce just about the same as in Kodachrome II. With the faster film speed, you can get some mighty fine pictures under poor lighting conditions.

If you're partial to Kodachrome, you'll want to pick up a roll of Kodachrome X and give it a try.

And other color news, too

Kodak Ektacolor Professional Film, Type S, is now available in the 120-roll size—a happy event for the advanced amateur. It's a negative-color film—primarily for prints—with an ASA of 80. Color couplers in the film provide automatic color correction.

For movie makers: bluer light

Sylvania now offers dichroic conversion filters for their Sun Gun lamps that raise the color temperature to 6,500 degrees Kelvin. What's the dichroic filter do? It splits off red light instead of absorbing it as a normal filter does, but with less loss of light. Result: a higher color temperature (bluer). The dichroic filter makes it possible for you to use outdoor color film indoors without a filter on your camera. You can shoot outdoor film all the time.

Also introduced by Sylvania for their Sun Guns is a diffusion lens with a wider beam spread, for wide-angle lenses.

Zeiss adds a fully automatic Contaflex

Been using the new Contaflex Super B

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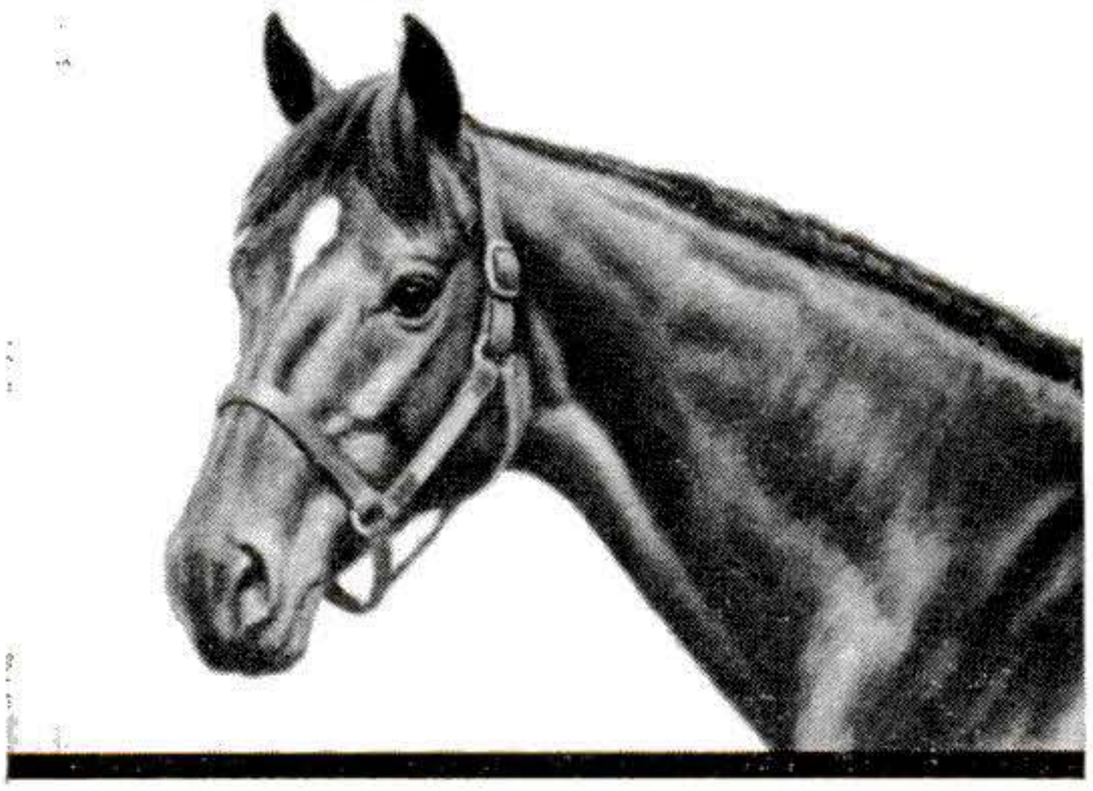
HOW TO WIN THE SON OF CITATION

SEE OPPOSITE PAGE



CONTEST RULES: 1. In not over 16 letters nor more than three words, print a name for the Kentucky Club prize colt. Count punctuation or space between words as letters. Use plain paper or entry blanks. Print your name and address.

2. Send as many entries as you like to—
Kentucky Club Derby Day Contest
P.O. Box 9K, Mount Vernon 10, N. Y.
Each entry must be accompanied by complete cellophane zip-off top from outer wrapper of any of Kentucky Club's 9 Master Blends of pipe tobacco: Aromatic Kentucky Club Mixture, Brush Creek, Crosby Square, Donniford, New Greenbrier, Kentucky Club White Burley, London Dock, Peper's Pouch Mixture, Whitehall. Entries must be postmarked not later than midnight April 8, 1963. No entries returned. All become property of Kentucky Club Division of Mail Pouch Tobacco Co.

3. Prizes will be awarded as listed. Entries will be judged by The Reuben H. Donnelley Corporation on the basis of appropriateness (specific reference to the characteristics and lineage of the horse), freshness (interest, creativeness, "sparkle"), and sincerity (believability). Judges' decision final. Duplicate prizes in case of ties. All members of a family may compete, but only one prize to a family.

4. Everyone in United States and possessions or Canada may enter the contest except employees of the manufacturers of Kentucky Club's Tobaccos, its advertising agencies and members of their families. Entries must be the original work of contestant. Contest subject to Federal, State and local regulations.

5. Winner of prize Thoroughbred will be notified in ample time to attend the Derby. Other winners will be notified approximately eight weeks after close of contest. The Son of Citation will be presented at Churchill Downs during Derby Day week.

If because of accident or other reasons it is necessary in the judgment of the Company to withdraw the colt described above, cash equivalent to the purchase price of the colt will be awarded. List of winning persons available to those requesting same and enclosing self-addressed, stamped envelope.

SEND TO:

KENTUCKY CLUB DERBY DAY CONTEST
P. O. Box 9K, Mount Vernon 10, N.Y.

NAME OF COLT. NOT OVER 16 LETTERS—MAXIMUM 3 WORDS .....

YOUR NAME (PLEASE PRINT) .....

STREET .....

CITY ..... ZONE ..... STATE .....

NAME OF DEALER .....

Use this form or plain paper and send each entry with a cellophane zip-off top from outer wrapper of any of Kentucky Club's 9 brands of pipe tobacco. Entries must be postmarked not later than midnight, April 8, 1963.

PHOTOGRAPHICALLY SPEAKING

for the past month and find myself getting lazy, with all those automatic features.

This 35mm single-lens reflex, with leaf shutter, is designed for the fan who wants to aim and shoot without bothering about other adjustments. Still, if you want manual control, you can quickly lock out the automatic system and switch over.

At a glance you can tell if there's enough light for shooting, just by peeking through the viewfinder. The aperture settings and shutter speed are clearly indicated on a scale to the side of the focusing area; if the pointer is within the green sector of the scale, there's sufficient light. I particularly liked the brilliant field seen through the finder.

Taking flash pictures with the Super B is also a snap. It has an automatic flash-programing device. You merely dial the correct flash-guide number (one set of numbers is for the normal 50mm lens, the other for the 35mm lens), insert a flash bulb, focus, and press the shutter release. The focusing control not only automatically selects the correct diaphragm opening, but limits the range of sharp focus to distances that give the correct exposures.

There's also a way to compensate for a back-lighted subject or for shooting into shadow areas. I increased the exposure one f/stop by simply turning the film-speed ring clockwise with my left thumb and holding it while I snapped the picture. The ring returns to its normal position as soon as it's released.

With all this automation, I could shoot pictures very rapidly. There's no getting 'round it—these automatic features really let you concentrate on the subject without worrying about the camera.

I did find the rapid-wind lever on the camera I used rather sticky compared with the smooth action of some SLRs.

Close-up booklet available

A new booklet on close-up photography came across my desk the other day from Hasselblad. It's an informative 16-page manual, thoroughly illustrated in color, and it's well worth having. You can get a copy free from your local dealer or by writing Paillard, Inc., 100 Sixth Ave., NYC.

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Win this son of Citation

he can win for you!

Kentucky Club Derby Day Contest

JUST NAME HIM AND HE'S YOURS

The most promising colt ever offered in a Derby Day Contest! His sire made racing history—Citation was the stakes winner of $1,085,760.

CITATION { BULL LEA / HYDROPLANE II

FAST JANE { FASTNET / DJAINA

Just think of the thrill of owning this great thoroughbred whose sire is a big stakes champion! Citation was the first horse to top the million dollar mark!

YOU don't have to do a thing but name him! Kentucky Club will feed and care for him—and pay his board and training to July 1, 1963. Then you can race him—or sell him—we hope you make a fortune either way!

Got a name? Just limit it to 16 letters, and not more than 3 words.

PRIZES GALORE!

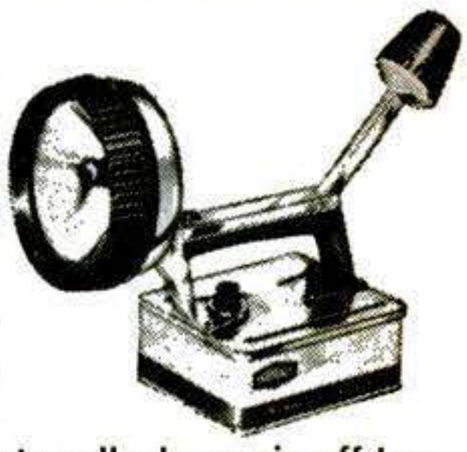
Winner will also receive 2 tickets to the Kentucky Derby plus hotel room for 4 days and $1,000 for fun and expenses!

2nd and 3rd prizes: Fully-equipped **14′ Glasspar 1963 Tacoma 100 boat,** with a classic-styled, dependable **Johnson electric-starting Super Sea-Horse** 40 h.p. outboard motor.

4th prize: $500 cash.

Additional prizes: 50 "Eveready" Captain stainless steel weatherproof lanterns with red beacon flasher, Alkaline battery and sealed-beam headlamp.

Plus over 500 wonderful prizes.

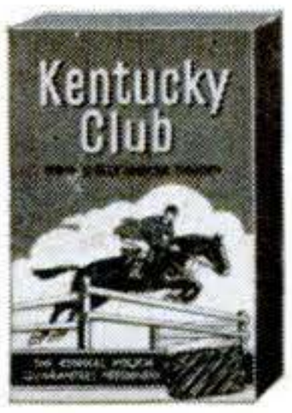


HOW TO ENTER THE CONTEST

Submit as many names as you'd like. With each entry send the complete cellophane zip-off top from the outer wrapper of any of Kentucky Club's 9 brands of tobacco. See the contest rules on the next page—and either mail in the coupon or use plain paper. Start thinking now. You may be a winner! Entries must be postmarked no later than midnight April 8, 1963.

See opposite page for full information.

Kentucky Club Tobaccos . . . . a blend for every taste.



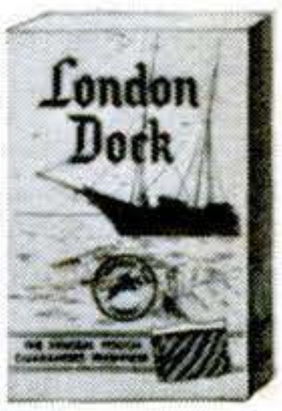
The finest Kentucky White Burley—cube cut for coolness

Superbly mild and aromatic, never burns hot.

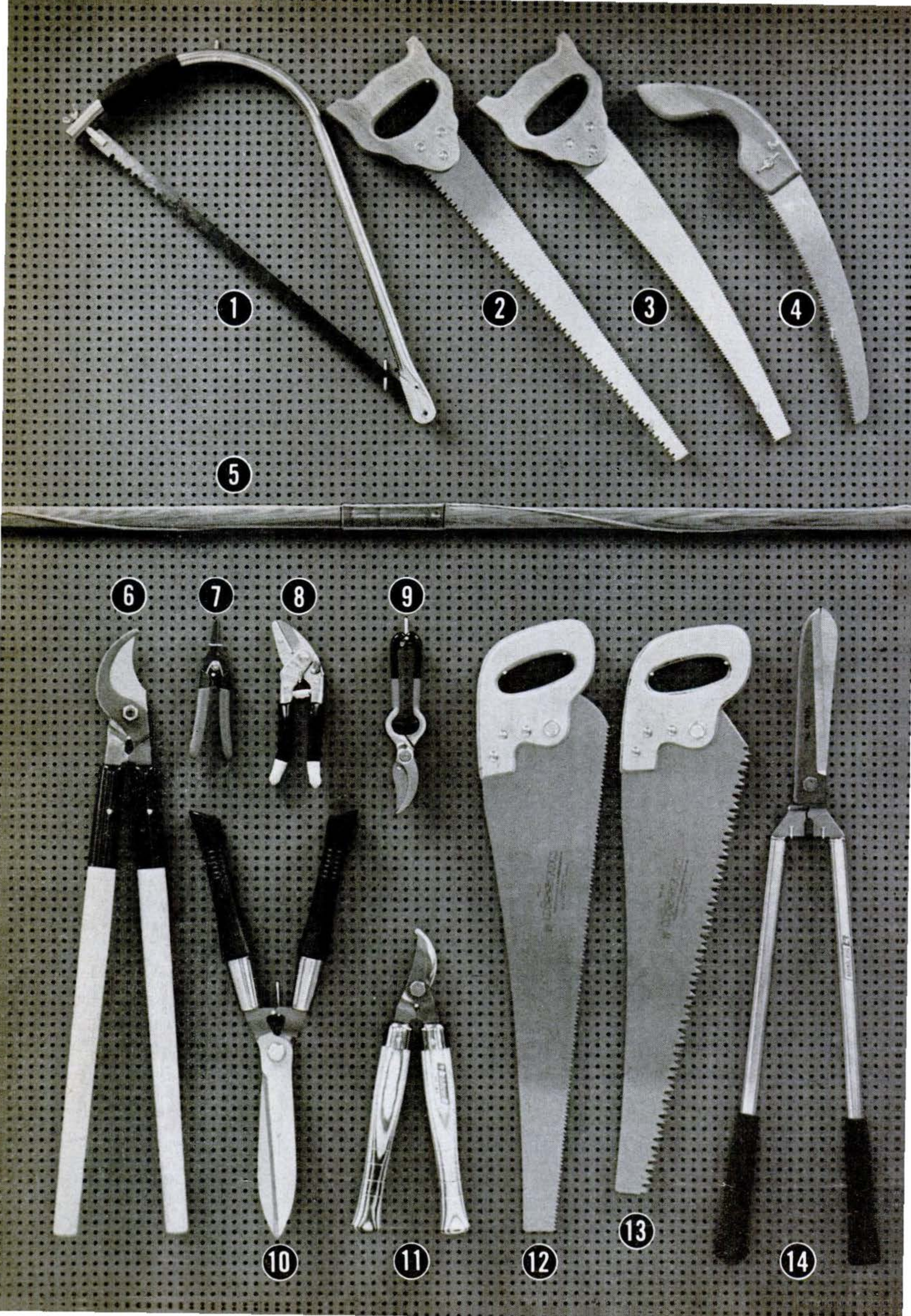
Smells so good because it tastes so good

Uniquely full bodied and rich tasting, yet pleasingly mild.

New! . . . menthol cool and mild with real tobacco taste.



A cool-burning English type tobacco, distinctively aromatic.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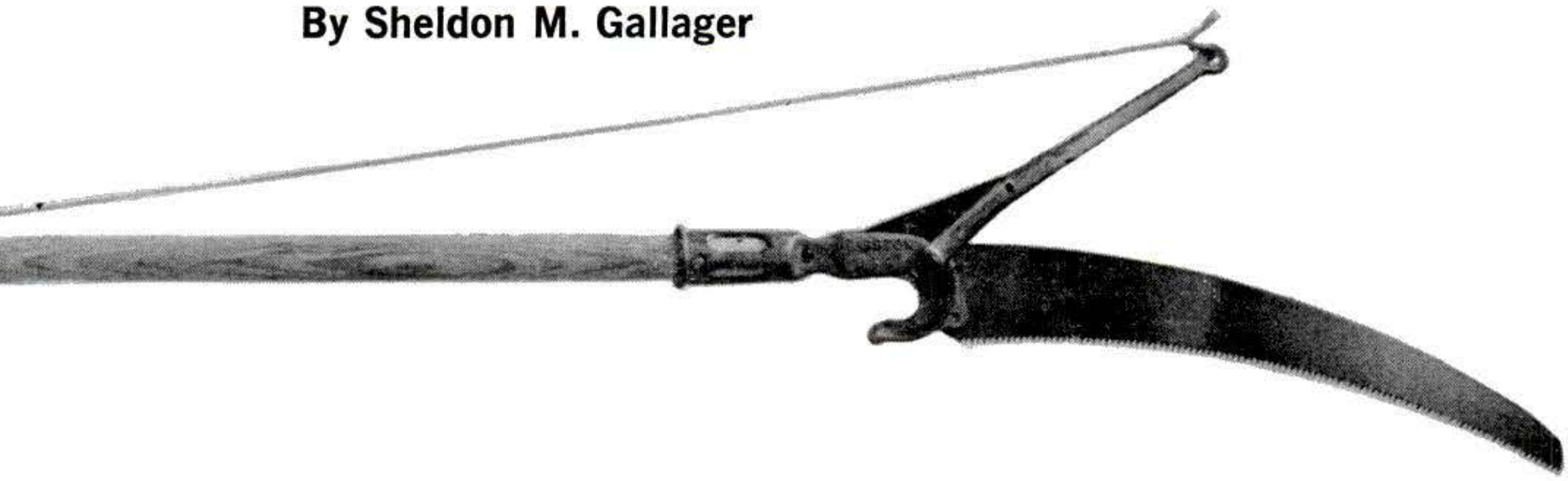
Big Choice in Pruning Tools

By Sheldon M. Gallager



There's a type for every job. Here are important facts to help you pick the best for your needs

IF YOU'VE ever doubted that pruning is a highly developed science, just take a look at the opposite page. Here's a whole tool board devoted to tools that do, primarily, one thing—prune.

How come so many? Proper pruning calls for precise, delicate cutting, usually of green wood—which is harder to cut—and often in places that are difficult to reach. To make the job go more easily, manufacturers have come up with many different cutting tools, each designed to solve a particular problem.

No one, except a professional gardener or tree surgeon, would be expected to own all of these tools. The trick is to select the ones that best suit your individual needs. Some of the tools are cleverly designed to handle more than one kind of cutting job. Some you'd want only if you do a lot of one particular type of pruning, say of very heavy branches or in tall trees.

The secret of good pruning is a cut that's clean, smooth, and as close to the main trunk or limb as possible. Cuts that are ragged, torn, or crushed do not heal quickly and allow rot to set in. All the tools shown here are designed to cut properly—but not under all conditions. You have to weigh the advantages of one against those of another in order to pick the best types for your jobs.

For small jobs, a hand pruner. This is the most popular all-around tool for light-

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What they are: 1. Small one-hand bow saw; 2. double-edged saw with eight-point teeth on one side, large tuttle teeth on other; 3. double-edged curved saw with pull teeth on concave side and push teeth on convex side; 4. eight-point folding saw; 5. combination pole pruner with lever-operated shear and 15" saw blade; 6. long-handled lopping shear; 7. rose shear; 8. anvil-type pruner; 9. shear-type pruner; 10. hedge shear; 11. short-handled lopping shear; 12. 26" six-point saw; 13. 24" tuttle-tooth saw; 14. long-handled hedge shear.

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Shear-type pruner, at far left, works like scissors. Adjustable pivot tension and heavy lower blade to give branches a solid support are marks of quality in this Disston design. Anvil-type pruner (center) has single blade that cuts against a soft metal plate. The handles on this Wiss model are angled slightly for a comfortable grip. Newest pruner is slim-blade rose shear at near left, designed by True Temper for sneaking easily into dense and thorny bushes.

duty pruning. It easily handles stems, twigs, and small tree branches, but not big ones. You wouldn't think you could do much to improve a simple shear like this, but makers have managed to come up with some interesting innovations.

The older shear-type pruner had two crisscrossing blades like a pair of scissors. Newer types have a single blade that's forced against a fixed metal plate or anvil. Having only one moving blade eliminates the familiar scissor problem in which the blades, when forced hard, simply twist apart and do more mangling than cutting. The anvil is made of soft metal so as not to dull the blade. When it becomes chewed up, you can replace it with a new anvil (on most makes; a feature to look for).

Looking for information on pruning techniques?

The following pruning guides are available free or at nominal cost from manufacturers of pruning tools:

"How to Prune," 25 cents, Seymour Smith & Son, Inc., Oakville, Conn.

"Pruning Guide," 25 cents, Disston Div., H. K. Porter Co., Porter Bldg., Pittsburgh.

"Dial-It Pruning Guide," 50 cents, O. Ames Co., Parkersburg, W. Va.

"Tree, Shrub, and Hedge Pruning," free, Atkins Saw Div., Greenville, Miss.

"Pruning Guide," free, Stanley Tools, New Britain, Conn.

"How to Prune for Better Flowers, Shrubs, Trees, and Fruits," 25 cents, J. Wiss & Sons Co., Newark, N. J.

The blades on several of the newer anvil-type pruners are offset at an angle to the handles. This allows you to keep the blade level while holding your wrist at a more comfortable natural angle. At least one maker, O. Ames, puts the blade at a full right angle to the handle. It's called a parrot-head pruner—and that's exactly what it looks like.

There's one limitation to the offset-head design. The recommended way to prune tree limbs is with the cutting blade against the underside of the limb to keep it from jamming in the crotch. Straight-blade pruners can be turned upside down for this, but the offset type can't be reversed as easily because it throws the blade angle in the wrong direction.

Most makers favor the anvil-type pruner because it can be made efficient at low cost—$2 to $3. There's nothing wrong with the shear type if you're willing to go for a quality make—from $5 to $10.

One British-made shear-type pruner, sold in this country by Wilkinson Sword in New York, has a unique double blade pivot designed especially to solve the twisting problem. One pivot holds the blades together so they can't twist, while a second pivot provides the cutting action. One advantage of a well-designed shear-type pruner is that it can cut closer to a tree trunk; there's no projecting anvil to get in the way.

For thick stuff, try a lopper. This, as its name implies, is for lopping off limbs that can't be handled by a hand pruner. Its long handles and tiny shear-type blades

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develop tremendous cutting force and will slice through 1″ branches as easily as a hand pruner nips off a rose stem. Experts warn, however, against overtaxing its efficient cutting range. It will handle stuff up to 1½″, but it makes its cleanest cut at about ¾″.

The long handles also give you an extra reach over hand pruners. Handle length varies all the way from 17″ to more than 30″. The longer the handle, the more leverage you get—but don't go overboard. A lopper that's longer than you really need may be awkward to handle. True Temper has introduced a shorty lopper, only 15″ long, for easy cutting at close range where you don't need a long reach.

Standard loppers sell for about $6 to $10. For extra-heavy cutting, you can get a compound-action lopper, like that made by H. K. Porter. This has a double pivot and a second set of lever arms that give a big boost in leverage. It's more expensive than conventional loppers, but can whack through limbs up to 2″.

Pole pruners extend your reach. For tree-top trimming or reaching way into thick growth, you need a helping arm. The Bartlett Tree Experts organization in Stamford, Conn., one of the country's leading authorities on professional tree care, points out the importance of pruning all the parts that need it—not just the parts you can reach easily. Chewing away at the bottom of a tree not only does nothing for its upper branches, but can spoil its overall appearance. Take notice—amateurs are occasionally guilty here.

A lever-operated shear mounted on a pole can snip off ¾″ limbs from 6′ to more than 20′ in the air. To operate the shear, you pull on a rope tied to the lever. For branches over ¾″, you can switch to a curved saw blade that's attached to a socket and slips on the end of a pole in the same way as the shear.

Several makers offer combination pruning heads that provide both a shear and saw blade in one. Prices for pole pruners start at about $7 or $8 for the head only—you supply the pole. Fancier versions are also available with sectional poles, some of lightweight aluminum, that can be added to as you need more length.

As in lopping shears, you have a choice of single or compound action. The simpler pole shears have a single lever controlling the blade. Some more advanced types add

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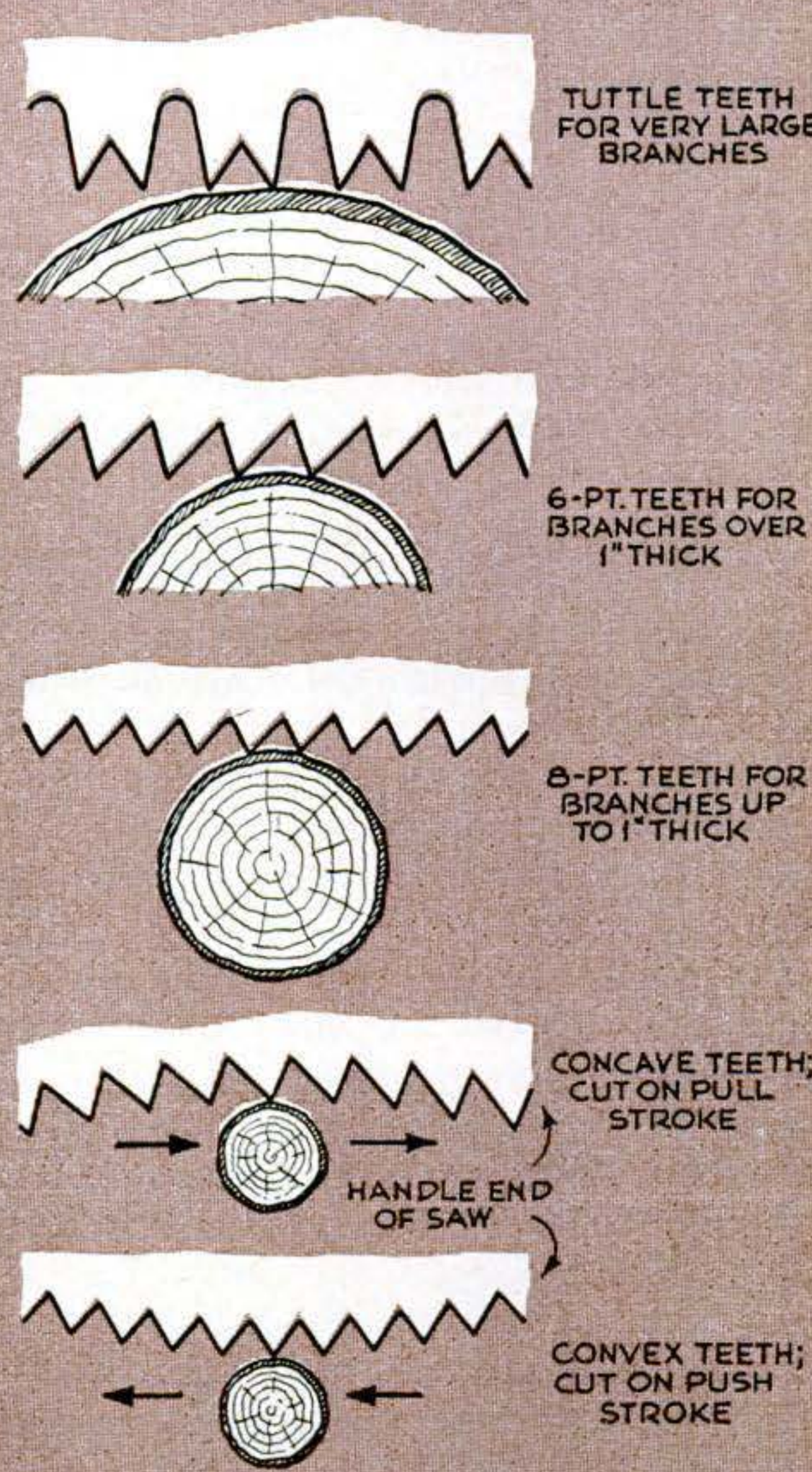
Folding saws have a pivoted blade that swings into a slot in the handle, making them safer to carry, easier to store. This Disston saw has eight-point teeth, is 19½″ long extended.

How pruning saws differ



Saw teeth, shown actual size, are big for fast cutting of large limbs. On thin limbs, fine teeth are better since they cut more smoothly. Saws that cut on pull stroke are easier to handle overhead.

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a second lever, connected to the first, to multiply leverage.

A few pole pruners use pull rods instead of rope to control the levers. The rigid rods, while an indication of quality, may make it difficult to change the length of your pole later. One advantage of the separate pruning heads is that you can use stock garden-tool handles to give you a variety of pole lengths. You can also get a handy telescoping pole, made by Seymour Smith, that extends from 6′ to 12′. It takes standard pruning heads.

How about hedge shears? These are not considered true pruning tools, but *can* be used for light cutting in a pinch. Most shears now have a semicircular notch near the base of one blade to hold small branches while the other blade shears them off. The notch keeps the branches from slipping as they're cut.

Shears with serrated blades are designed to cut somewhat heavier growth than the plain-blade type. Still, hedge shears are not an ideal pruning tool. One problem is that they promote a normal human temptation to slice off everything in sight instead of being selective—and that's not the way to prune.

When should you use a saw? A pruning saw is the only answer for heavy limbs, but in between you have some choice. On trees that can be climbed or reached with a ladder, you may find it easier to trim branches with a small handsaw rather than to grope around with a long pole pruner. Pruning saws are handy in high or cramped places since they need only one hand—lopping shears require two. Often you can make closer cuts with a saw than with shears.

But there's another side to the coin: According to experts at the Department of Agriculture's Forest Service, "Knife-cut surfaces are better than sawed surfaces because the smooth surface is less apt to rot and promotes faster covering by new growth." Moral: Use shear-type tools on small growth, but switch to a saw as soon as the blades start giving a crushed or ragged cut—usually long before they reach their maximum cutting ability.

Pruning saws, unlike carpentry saws, are specially designed to handle green wood that causes conventional blades to stick and bind. To work well, they must have big, wide-set teeth to clear a path considerably wider than the blade itself. The bigger the teeth, the faster the cutting, but the rougher the surface.

Eight-point teeth (eight teeth to the inch) are about the smallest used in pruning and make the smoothest cut. Coarser six-point teeth are usually used on limbs over 1″ thick to speed up the cutting, and some saws offer even faster four- and five-point blades. For very large branches, there are big, open teeth similar to those on lumbering saws. These are called tuttle teeth and are the fastest-cutting of all.

Several makers, like Disston and Atkins, offer double-edged saws that give you a fine-tooth blade on one side for small limbs and a large-tooth blade on the other for thick stuff. These save buying two saws, handle a wide variety of pruning jobs, and are a good buy for the home owner at $4 to $5. The only drawback of a double-edged blade is that you have to be a bit careful in handling—it can bite.

Curved blades. Many pruning saws have curved blades—for an interesting reason. When you're pruning overhead, it's a lot easier to pull the blade down toward you than to push it up away from you. So the curved blades have teeth that are arranged to cut on the pull stroke instead of on the push stroke as in conventional saws. The curve of the blade hooks naturally over a branch and is drawn into the wood as you pull the saw toward you, helping the teeth to bite.

Another advantage of the curved blade is that it gets the same number of teeth as a straight blade into a shorter length and is thus a little easier to maneuver in tight quarters. However, if most of your pruning is at or below arm level, you'll do better with a push-type blade.

One unusual combination, made by Disston, is a double-edged curved blade that gives you a choice of pull-cutting teeth on the concave side and conventional push-cutting teeth on the convex side. Atkins offers a curved-blade saw that can be detached from its handle and mounted on a pole pruner so you buy only one tool.

For average yard work, you're better off with the shorter 18″ to 20″ pruning saws. They're easier to maneuver and less expensive than the big 26″ and 28″ saws used mainly by pros. If your yard chores include firewood cutting, a small bow saw, fitted with a tuttle-tooth blade, is a good compromise. It handles heavy logs as well as light branches. ■ ■

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"Just in case they're biting at the water hole!"

New Johnson Compacts

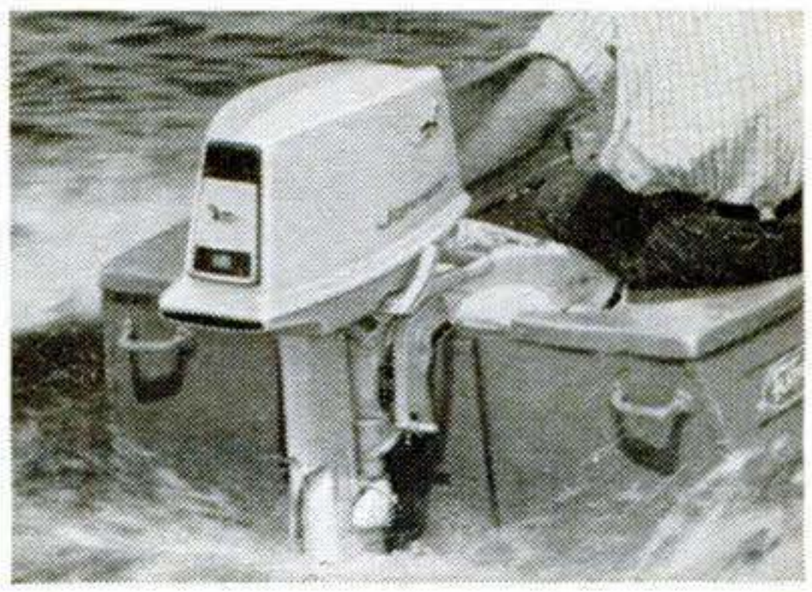
Famous Sea-Horse dependability! Now with a 2-year warranty!

F-o-r-e! Make way for the new '63 Johnson Compacts! Above is the 5½ hp model. In action at the right is the 10. And there's also a versatile 18.

Outside: slim, trim, light. Inside: very big on quality. Corrosion-proofing and thermostatic cooling. Super silencing and cushion-hub prop. PLUS... a new 2-year warranty policy... parts *and* labor.

Other Sea-Horse motors at your Johnson dealer's: Electramatic 75 and 40's, a 28 hp "Convertible" and a timeless, tireless 3.

Free '63 catalog. Write Johnson Motors, 1363 Pershing Rd., Waukegan, Ill. Div. Outboard Marine Corp.



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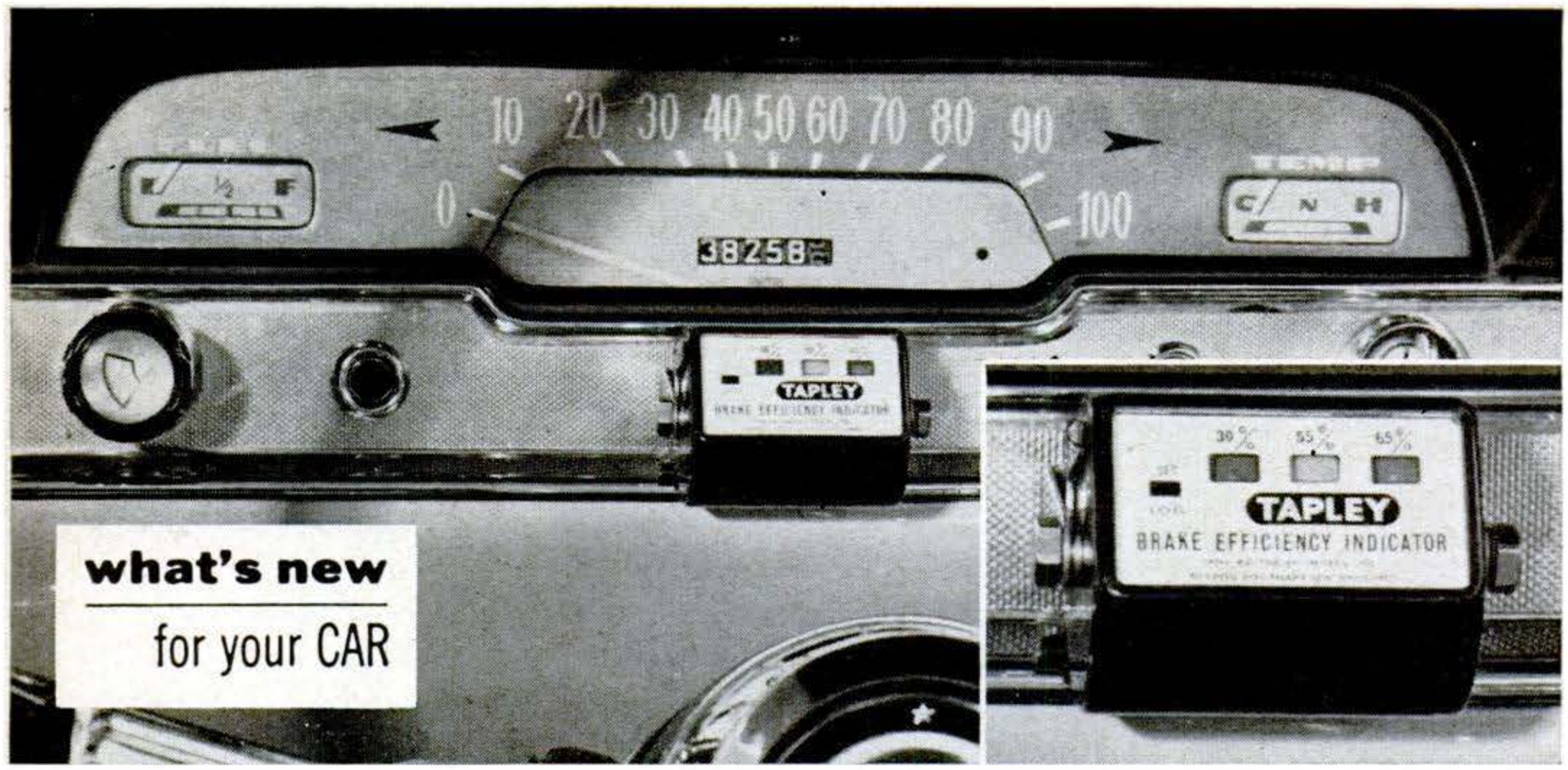
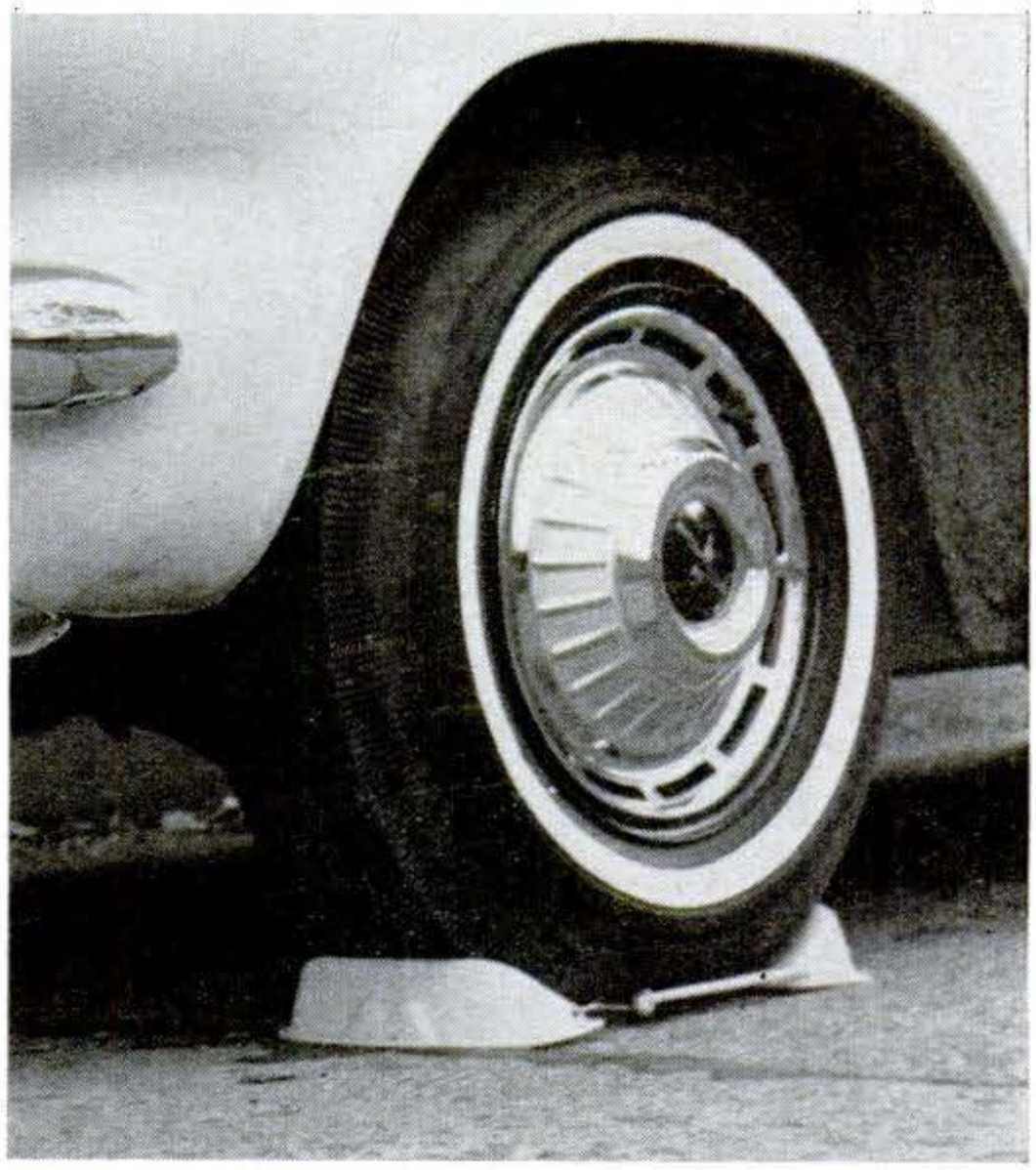


Meter Tests Efficiency of Your Brakes

You can check brake adjustment and lining wear regularly with this dashboard indicator. Three windows show approximate rates of deceleration. Pivoted tubes, hung at progressively steeper angles, each contain a steel ball that rolls forward when brakes are applied. When the ball passes the fulcrum point, the tube tilts, displaying a colored shutter in the appropriate window. Minimum recommended handbrake efficiency is 30 percent; 55 percent is the foot-brake minimum, but 65 percent is safer. This scale is derived from 100-percent efficiency—retardation of 32 feet per second per second. Tapley Products Inc., 53 Park Pl., NYC 7. $8.50.

Battery charger bolts to bulkhead

This four-inch-long battery charger can be installed permanently in the engine compartment or used as a portable. The Thor unit operates on 110-volt house current and provides a slow charge. Electrotone Laboratories, Chicago. $4.95.



Lightweight chocks prevent rolling

Plastic wheel chocks clip on easily without your jacking up the wheel. They are available in bright yellow, orange, and white, and weigh less than a pound for a set of four. Price is $5 a set. Robinson Industries, Coleman, Mich.

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Even the styling says "go." Note that racy new hardtop roof. It's not only beautiful, its aerodynamic styling cuts air resistance. Choose from two models: the Marauder with a big 390 V-8 standard engine . . . or the Marauder S-55, with console-mounted transmission selector, bucket seats, and 4-barrel Super Marauder 390 V-8 standard engine. Talk about hot! Talk to your Mercury dealer.

MERCURY
MONTEREY · MONTEREY CUSTOM
MARAUDER and S-55

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CALIFORNIA

ALAMEDA
Alameda's Vosburgh Service Hardware
2317 Santa Clara

BAKERSFIELD
Bakersfield Sandstone & Brick Co.
18th & Sonora
Egland Lumber Company
2101 Edison Highway
Greenfield Hardware, Inc.
9545 S. Union
Oak Lane Hardware
714 Oak Street
Pioneer Mercantile Co.
1112—20th St.
Stewart's Hobby Shop
900—21st Street

BELMONT
Belmont Hardware
940 El Camino Real

BURLINGAME
Burlingame Hardware
1348 Burlingame Ave.

CARLSBAD
Carlsbad Hardware
2840 State Street

CHULA VISTA
Syd Hall Hardware
Corner 3rd & "F"

DELANO
Delano Hardware Company
1020 Main Street

EL CAJON
The Hayseed
456 No. Magnolia

ESCONDIDO
Churchill & Cassou Hardware
140 E. Grand Ave.

FORT BRAGG
Sea Fair
303 No. Main Street

HAYWARD
Skaggs Hardware
22423 Foothill Blvd.

MILPITAS
Milpitas Hardware
111 S. Main Street

MONTA VISTA
Monta Vista Paint & Hardware
21695 Steven's Creek Road

MORGAN HILL
Squeri Bros. Hardware

OAKLAND
Laurel Hardware
3920 MacArthur Blvd.

OILDALE
Sudds Hardware
911 N. Chester Avenue

PALO ALTO
Everley's
550 Waverly

PORTERVILLE
Jones Hardware
311 North Main Street

REDWOOD CITY
Imperiale Hardware
Woodside Plaza

SAN CARLOS
Star Hardware
654 Laurel Street

SAN DIEGO
College Hardware
6107 El Cajon Boulevard
Hillcrest Hardware
5th & Robinson

SAN FRANCISCO
Brownie's Hardware
1552 Polk St.
Fredericksen Hardware
3029 Fillmore St.
Howse Hardware
2729 Mission Street

SAN JOSE
Bell Hardware
1120 South Highway 9
Ed's Hobby Shop
1362 Lincoln Avenue
Glaze Hardware
536 So. Bascom Ave.
Hobby Time
2720 S. Bascom Ave.

CALIFORNIA—Cont'd

Huston's Hobby Shop
1004 Town & Country Village
335 S. First Street
Mount Pleasant Hardware
3058 Story Road
Park Avenue Hardware
1737 Park Avenue
Village Hardware
3461 Steven's Creek Boulevard

SAN LEANDRO
Lind's Hardware
1256 Davis Street

SAN MATEO
Wisnom's
130 "B" St.

SANTA CLARA
Villa Hardware
5203 Steven's Creek Boulevard

SHAFTER
Central Hardware
242 Central Avenue

SUNNYVALE
Sunnyvale Hardware Co.
175 El Camino Real

TAFT
Pioneer Mercantile Co.
430 Main

DISTRICT OF COLUMBIA

Glen Echo Hardware Inc.
7303 MacArthur Blvd.

FLORIDA

ST. AUGUSTINE
Morrison's Hardware
195 King St.

ILLINOIS

BENSENVILLE
Laho's True Value Hardware
Main & York St.

CHICAGO
Berg's Paint & Hardware Co.
2558 West 63rd Street
Kaup's Ace Store
1140 W. 70th Street
Ace Hardware
7230 W. Foster Avenue

DES PLAINES
Ace Hardware
694 Lee Street

EDWARDSVILLE
Edwards Bargain Barn
Route #4

ELMHURST
Soukup's Hardware Dept. Store
116 N. York Street

MT. PROSPECT
Mt. Prospect Hardware
101 W. Prospect Avenue
Wille Lumber & Fuel
100 W. Northwest Hiway

OAK PARK
Dressel's Ace Hardware
1127 Chicago Avenue

RIVER FOREST
Dressel's Ace Hardware
7711 Lake Street

WINFIELD
T. S. Bowie & Sons
Beecher Street

INDIANA

LA PORTE
Kabelin Hardware

IOWA

COUNCIL BLUFFS
Katelman Hardware
714 West Broadway

FORT DODGE
Ferguson Hardware
516 Central Ave.

HAMPTON
Black & White Stamps Inc.
112 Second St. N. W.

POCAHONTAS
Byrd's Hardware
101 North Main

KANSAS

ATCHISON
Domann Drug Store
504 Comil St.

HAYSVILLE
Haysville Hardware & Lumber, Inc.
Main & Grand

HUTCHINSON
Reno Hardware
215 South Main
1304 North Main

KANSAS CITY
Drew's Hardware
1010 Central Avenue
W. T. Foley Electric Supply Co.
29 No. 10th Street
Mack Lumber Company
So. 26th & Metropolitan

LEAWOOD
Ranch Mart Hardware
3742 West 95th Street

MISSION
Mack Hardware
6004 Johnson Drive
Mission Hardware
5606 Johnson Drive
Suburban Hardware
5103 Linden

OVERLAND PARK
Dales Hardware & Sporting Goods
7919 Santa Fe Drive

SALINA
Kampus and Hiway Sundries
1412 So. Santa Fe
901 No. 9th Street

SHAWNEE
Hartman & Sons Hardware
11018 Johnson Drive

WICHITA
Davids, Inc.
11000 East Kellogg
Home Lumber and Supply, Inc.
1250 South Seneca
Hupp Hardware
1101-1105 East Harry
Neal Hardware
722 North Main Street
Wood's Hardware
1721 East 21st Street

MARYLAND

HYATTSVILLE
Adelphi Hardware
2508 University Boulevard, East

LANGLEY PARK
Murray Hardware Company
8000 New Hampshire Avenue

LANHAM
Stancliff Hardware
Carrollton Shopping Center

ROCKVILLE
Poch Hardware
Congressional Center

TACOMA PARK
Center Hardware
6867 New Hampshire Ave.

WHEATON
Pendleton Hardware
11300 Georgia Avenue

MASSACHUSETTS

BRIGHTON
Home Supply Company
366 Washington Street

BROCKTON
Grossman's—Brockton
69-85 No. Montello St.

BROOKLINE
Connelly Hardware
706 Washington St.

JAMAICA PLAIN
Forest Hills Hardware
2 Hyde Park Avenue

MAYNARD
Parker Hardware Company
77 Main St.

NEEDHAM
Allen Hardware Co.
1026 Gr. Plain Ave.

MASS.-Cont'd

NORTH ATTLEBORO
Franklin Hardware
41 Richards Ave.

NO. CAMBRIDGE
Masse Hardware Co
249 Walden St.

RANDOLPH
Curran's Hardware
67 No. Main St.

SOMERVILLE
Davis Square Hardware
21 Holland Street

SO. WEYMOUTH
M. R. Loud & Company
10 Union Street

WELLESLEY HILLS
Kidston Hardware
12 Washington St.

W. NEWTON
A. J. Harris Hardware
1276 Washington St.

MICHIGAN

DEARBORN
Ace Budget Centers, Inc.
22501 Michigan
Gales Hardware
25411 W. Warren
Liberty Lumber Company
6235 Schaefer

DETROIT
Ace Hardware
17733 Schoolcraft
Roy P. Bushie & Sons
21230 W. Seven Mile Road

OAK PARK
Ace Hardware
8520 West 9 Mile Road

PORT HURON
Beard Campbell Company
514-20 McMorran Blvd.

ROSEVILLE
Lambrecht Lumber & Supply Co.
25260 Gratiot Ave.

TAYLOR
Crowley Hardware Company
22360 Goddard Road

VAN DYKE
Theut's Toy Village
23335 Van Dyke Ave.

MISSOURI

BELTON
Steinbruechk's, Inc.
311 Main Street

BRIDGETON
Alsam's Sporting Goods
3415 North Lindbergh Blvd.

CREVE COEUR
Creve Coeur Supply Company
11623 Olive Street Road

FLORISSANT
Korte Hardware
610 St. Francois St.
#1 Mullamehy Gardens

INDEPENDENCE
Fairmount Hardware
10202 Independence Avenue

KANSAS CITY
Bargain Spot Lumber
3201 East 85th Street
Broadway Hardware Co.
311 Westport Road
Northeast Hardware
4434 St. John Street
Ruskin Hardware
11152 Blue Ridge
South Prospect Hardware
7230 Prospect

LEMAY
Kingston Hardware
2616 Telegraph Rd.

OVERLAND
Overland Hardware Co.
2520 Woodson Rd.

UNIVERSITY CITY
Beyers Lumber Company
8684 Olive Street

WEST ALTON
Gambill's Bargain Barn

Weller® Power Tools...

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OMAHA
Bill's Hardware
4684 Leavenworth Street
National Car & Home
1502 Capitol Avenue
Osoff's Hardware
44th & Dodge Street
Pine Tree Hardware, Inc.
325 North 72nd Street
Price Hardware
8611 North 30th Street
Schollman Hardware
4114 North 24th Street
Uptown Hardware
4922 Dodge Street

NEVADA

ELKO
W. C. Moell Hardware
533 Railroad Street

NEW HAMPSHIRE

CONCORD
Sanel Auto Parts, Inc.
219-223 S. Main

KEENE
Sanel Auto Parts, Inc.
38 Emerald Street

LANCONIA
Sanel Auto Parts, Inc.
128 New Salem St.

MANCHESTER
Sanel Auto Parts, Inc.
321 Elm St

PLYMOUTH
Sanel Auto Parts, Inc.
135 Main St.

ROCHESTER
Sanel Auto Parts, Inc.
132 So. Main St.

WEST LEBANON
Sanel Auto Parts, Inc.
59 Main St.

NEW JERSEY

ASBURY PARK
S. Lazarow, Inc.
621 Main St.

BELMAR
Taylor's Hardware
914 F Street

BRICKTOWN
Community Lumber
Moore Road

HILLSDALE
Orstock Sales, Inc.
372 Broadway

LAKEWOOD
Friedland's Supply
Lakewood Hardware
305 Main Street

NEPTUNE
Factor Hardware Co.
Jumping Brook Shopping Center
Route 33

RED BANK
Jacobs Hardware Co.
273 Shrewsbury Ave.

SEASIDE HEIGHTS
McDevitt's Hardware

TOMS RIVER
Western Auto Associate
814 Main Street

OHIO

CINCINNATI
Wolf Hardware & Paint
5830 Hamilton Ave.

CLEVELAND
Big 4 Lumber Co.
6900 Granger Road
Huntley Hardware & Garden Center
4178-86 Rocky River Drive
Koller Bros. Hardware
724 Prospect—13802 St. Clair

OHIO—Cont'd

Koller Hardware
5324 Northfield
Southgate Shopping Center
Loew's Hardware, Inc.
1035 Prospect Ave.
1034 Huron Rd.
Riverside Hardware Co.
17015 Lorain Ave.

DAYTON
Gem City Hardware
3420 N. Main St.
5500 Brandt Pike
Hess Hardware
4259 W. 3rd Street
PK Home Shopping Center
6171 Far Hills
The G. W. Tischer Hardware Co.
23 East Second Street
2315 Far Hills Ave.
Throckmorton's, Inc.
5418 Kemp Road

EAST CLEVELAND
C. W. Koenig Company
13,612 Euclid Avenue

EUCLID
C. W Koenig Co.
25,801 Euclid Ave.

LAKEWOOD
Fruehauf Hardware Co.
17702 Detroit Ave.
Lakewood Hardware
11826 Detroit Ave.

MAYFIELD HEIGHTS
Big 4 Lumber Co.
5919 Mayfield

MIDDLETOWN
Ace Hardware #317
20 North Broad St.

SHAKER HEIGHTS
Kinsman-Lee Hardware
16765 Chagrin Blvd.

OKLAHOMA

BARTLESVILLE
Maltby Bros.
301 Johnstone

HASKELL
Haskell Hardware Co.
Corner of Main & Broadway

OKEMAH
S & S Hardware
207 W. Broadway

OKMULGEE
Bullard's Furniture & Hardware
115-117 East 5th

PAWHUSKA
Benson Lumber Co.
North 1020 Lynn Street

TULSA
Clark-Darland
119 E. 1st Street
Dale Carter Lumber Co.
1946 Utica Square
Hanna Lumber Company
302 S. Peoria
Vern Jewelry & Home Store
706 S. 49th Ave.

PENNSYLVANIA

ALLENTOWN
Philmor Hardware
7th Street Pike

AMBLER
Cranes Hardware
Bethlehem Pike

BERWYN
Berwyn Hardware
618 Lancaster Ave.

BROOMALL
West Chester Hardware
2548 West Chester Pike

CONSHOHOCKEN
Kehoe Hardware
109 Fayette St.

DOYLESTOWN
Shive's
Main & State

DREXEL HILL
Marshall's Hardware
3621 Garrett Road

FAIRLESS HILLS
Fairless Hills Hardware
Fairless Hills Shopping Center

PENNSYLVANIA—Cont'd

FERNWOOD
Master Hardware
3 So. Church Lane

HAVERTOWN
Manoa Paint & Hardware Co., Inc.
Manoa Shopping Center

LEBANON
Bargaintown U. S. A. Inc.

MONESSEN
Monessen Plumbing & Electric
Donner Ave.

MT. PENN
Leinbach Hardware
2239 Perkiomen Ave.

NARBERTH
Ricklin's Hardware
203 Haverford Ave.

NEWTOWN SQUARE
Barrett's Hardware
St. Albans Shopping Center

NORRISTOWN
Star Hardware Co.
614 W. Marshall St.
Joseph J. Zummo Hardware Co.
259 East Main St.

PENN SQUARE
Swede Square Hardware
Swede Square Shopping Center

PHILADELPHIA
Fisher's Hardware
6910 Torresdale Ave.
Hennings Paint & Hardware
5809 Germantown Ave.
B. F. Maurer Hardware
4343 Main Street
Red Lion Hardware & Supply Co.
Red Lion & Venee Road
S & H Hardware & Supply Co.
6624 Castor Ave.
Siwek Hardware
130 Huntingdon Pike
Weber Hardware
5512-14 N. 5th

PITTSBURGH
Eiben & Irr
606 Wood St.

PLYMOUTH MEETING
Plymouth Hardware
Ridge & Butler Pikes

READING
Philmor Hardware
W. Lancaster Ave. & Thomas Drive
Winters Hardware
400 N. Ninth Street
Winters Hardware
620 N. Front Street

SOUTHAMPTON
Weber Industrial Sup. Co.
501 Street Road

TROOPER
Park Ridge Hardware
Park Ridge Shopping Center

YORK
Master's Stores Inc.
1121 S. Edgar St.

RHODE ISLAND

GARDEN CITY, CRANSTON
Garden City Hardware
41 Hillside Road

PAWTUCKET
Bessette Hardware
578 Broadway

PROVIDENCE
Enterprise Hardware
365 Atwells Ave.
Mt. Pleasant Hardware
1097 Chalkstone Ave.

WEST WARWICK
J. B. Archambault's Annex
173 Washington Street

TENNESSEE

KNOXVILLE
Southside Hardware Co.
3909 Martin Mill Pike

NEWPORT
Newport Hardware Co.

UTAH

OGDEN
Lowe's Hardware
2326 Washington

SALT LAKE CITY
Keith's Hobby House
170 E. 8th South
Ketchum's Builders Supply
4th South at 7th West

VIRGINIA

BAILEY'S CROSSROAD
Yeatman's Sports & Hardware
820 Leesburg Pike
Bailey's Crossroad Shopping Center

BON AIR
Bon Air Hardware
8801 Forest Hill Ave.

HAMPTON
Sinclair Hardware
44 West Queen St.

LYNCHBURG
Fairview Hardware
3401 Campbell Ave.

NORFOLK
Bourne & Son Hardware
8012 Virginia Beach Blvd.
Hobbs Hardware
24 Southern Street
Reynolds Hardware
6611 Virginia Beach Blvd.
Triangle Hardware & Supply Company
3614 Tidewater Drive

PORTSMOUTH
Armistead Morrison Company
4036 Portsmouth Blvd.
Portsmouth Hardware
3619 High Street
Standard Hardware Corp.
603 Middle Street

RICHMOND
City Hardware
1317 Hull Street
Kelley's, Inc
5047 Forest Hills Avenue
Musick & Miffleton Hardware
3102 W. Broad Street
Ridge Hardware
Beverly Hills Shopping Center
Guy Smith Hardware
5809 Patterson Ave.

STAUNTON
Worthington Hardware
26-28 W. Beverly Street

TAPPAHANNOCK
Western Auto Associate

VIRGINIA BEACH
Plaza Hardware
Princess Anne Plaza Shopping Center
Virginia Beach Hardware

WINCHESTER
John S. Miller & Company
112 Loudoin Street

WEST VIRGINIA

WHEELING
Levin Auto Parts, Inc.
23rd & Main Streets

WISCONSIN

BROOKFIELD
Gilbert's V & S Hardware
17045 W. Capitol Drive

MILWAUKEE
Aug. G. Nowicki & Sons
2567 So. 12th St.
Staadt Ace Hardware
2816 N. Teutonia Ave.
Steinbrinner Paint & Hardware
7600 W. Capitol Drive
Wucker's Ace Hardware
7900 W. Burleigh St.

WAUKESHA
Ace Hardware
155 Main St.

WEST ALLIS
Neis Ace Store
7943 West National

are featured at these fine stores

WELLER ELECTRIC CORP., EASTON, PA.

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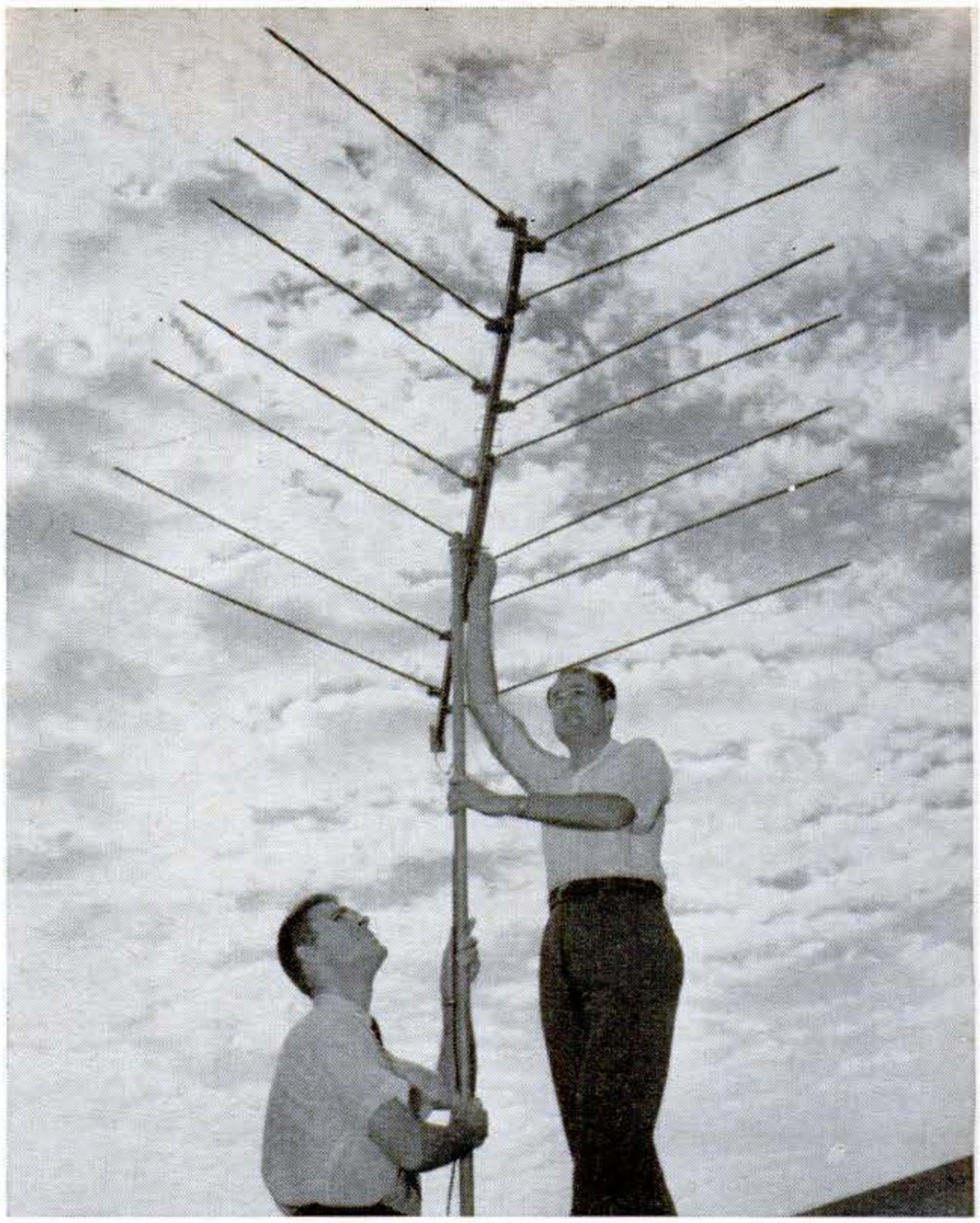
Powerful New Antenna for TV and FM, too



Early research model of the LPV is being adjusted here by the designer, Prof. Paul Mayes. This version worked fine, but turned out to be too expensive for mass production.

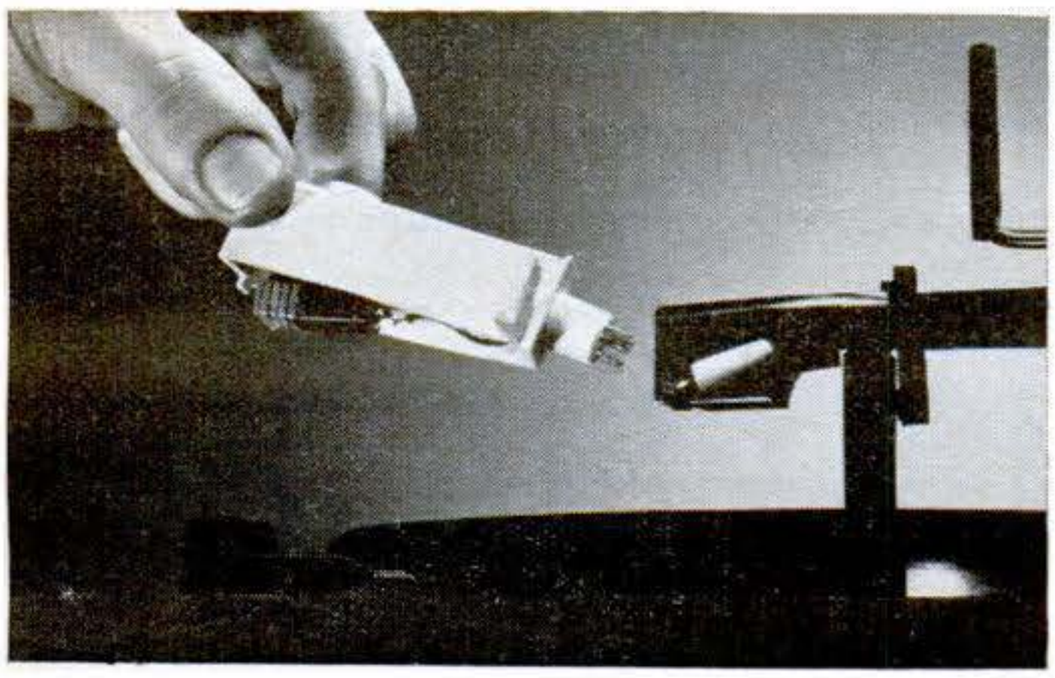
THE wraps have just come off a remarkable new antenna. It will give TV viewers and FM listeners the benefit of know-how engineers gained in licking the problems of communicating with satellites.

This relatively compact antenna, the LPV, will feed your TV or FM stereo receiver an exceptionally strong signal over the entire VHF band (Channel 2 through 13 and FM stereo). Furthermore, it rejects ghosts and interference reaching it from the back and sides, as positively as a long-john yagi (which can be made to work efficiently on only one channel).

New to consumer TV, but basic to many space-communications antennas, the principle of operation is known to engineers as the *log periodic* principle. (We'll get to the V in LPV in a moment.) In fact, the LPV was developed by some of the same scientists at the Antenna Research Laboratory of the University of Illinois who designed the conical spiral antenna used in the Transit satellite. It is, mathematically, a flattened version of that design.

The LPV looks like the skeleton of a streamlined flounder. The elements are longest at the rear and get successively shorter toward the front. They are tilted forward to make a V—that V in LPV.

Even if you're not a mathematician, you can get a rough idea of how the LPV works if you'll think of a long escalator with people hopping on at each of several floors. The signal picked up by each set of elements is continuously passed along a zig-



No-scratch, bounceproof cartridge

A retractable cartridge assembly allows this high-compliance pickup to be used safely on a record changer. The new Shure Gard-a-Matic is complete with head, ready to plug in to the arm of a Garrard automatic turntable. Tracking at 2 to 2½ grams, the cartridge retracts if pressure exceeds 3 grams or the arm is accidentally dropped on the record. Price: $49.50.

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Production model of the LPV shown here is the LPV-11, designed for fringe areas. The 11 sets of elements (or cells) include two directors in front for sharper response on the high channels. The antenna is highly directional, with minimum response to the sides and back. Uniformity of gain over complete VHF band is said to give better color reception.

zag network of bars to the antenna terminals. The trick is to keep all the waves adding together in phase. The result is a whopping big signal sent down to the TV set. The LPV achieves this by arranging the elements according to a log-periodic formula that fools the signals into acting as though the separate elements were actually a huge, continuous spiral, constantly in phase.

JFD Electronics, Brooklyn, N. Y., makes the commercial version of the LPV in six models to suit different receiving conditions. The smallest and least expensive, the LPV-4, has four sets of elements—adequate for high signal areas close to TV stations. The largest is the LPV-17 with 17 sets of elements; it would ordinarily be used for far fringe reception or areas where there are particularly troublesome local conditions.—*Charles Tepfer.*

Delivers 117-volt AC from battery

This transistorized power converter will deliver, continuously, 175 watts of household-type, 117-volt AC power from a storage battery. Two AC receptacles allow plugging in of any pair of electrical appliances or power tools for operation from your car or boat battery. Kit takes about two hours to build. Available from Heath, Benton Harbor, Mich. $29.95 in kit form.

CONTINUED

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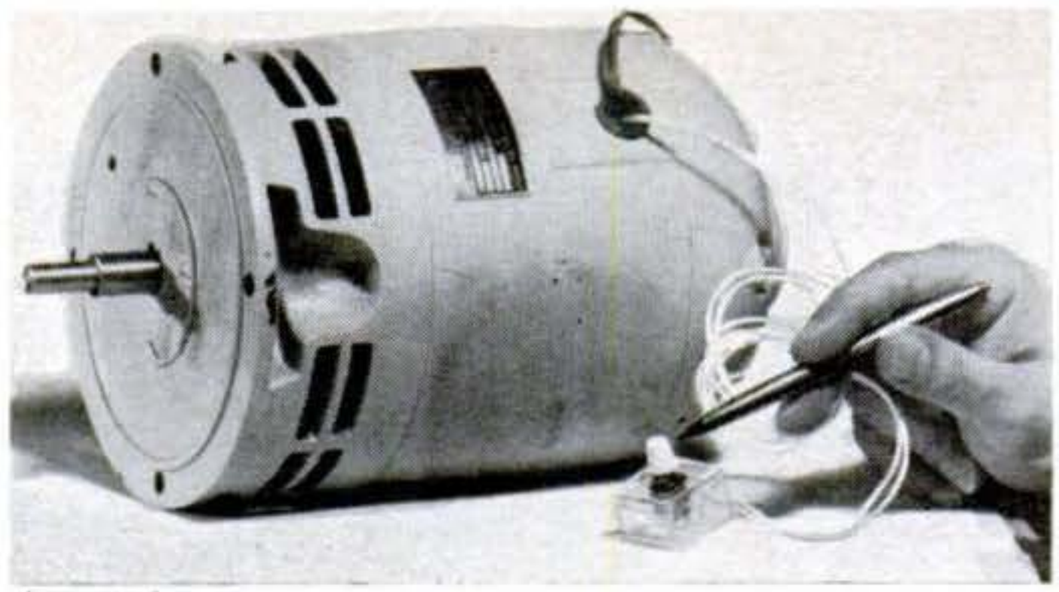
Variable-Speed Motor Is Brushless



Speed can be controlled by tiny variable resistor no larger than volume control on your radio (top). Below, parts of standard motor are shown next to those of a Komlectro motor.

TRANSISTORS have solved another problem—this time by taking over the job ordinarily done by a commutator and brushes in small electric motors. Lamb Electric is now manufacturing the Komlectro brushless motor, which, they emphasize, commutates entirely electronically.

The new motor combines the advantages of the induction motor and the brush-type series-wound motor. Induction motors, like those on washing machines, stationary power tools, and other large home appliances, generally have a long, service-free life. But they are relatively large and heavy for their power output and they are essentially constant-speed—their speed depends on the frequency of the line current. Maximum speed is limited to 3,600 r.p.m. by the 60-cycle AC.

Series universal motors, found in electric drills, food mixers, vacuum cleaners, routers, and portable saws, develop a lot of power for their size and are *not* limited in speed by line frequency—but they use brushes, which wear out fairly soon, and the motors need frequent service. Arcing between brushes and commutator causes TV and radio interference, and is a hazard in an explosive atmosphere. Motor speed can be controlled, but controllers are bulky and expensive.

The Komlectro brushless motor has the speed and compactness of the series universal motor but is made like an induction motor. The trick is in converting the input current (it can be either DC or AC) into a variable-frequency AC. Since the speed of an induction motor depends on the frequency, you can increase speed by increasing frequency. Built-in transistors are hooked up in an oscillator circuit that uses the motor windings themselves as both the oscillator coil and output transformer.

An oscillator, of course, is simply an electronic means of causing the current to change direction of flow very rapidly. The faster this occurs, the faster the motor will run.

Gadget gauges check record player

Surprisingly accurate gauges for checking your record player can be made simply by punching and folding a card and inserting paper clips and pennies. You can check stylus force, bearing friction, level, arm set-down, and stack clearance. Gauges are printed on a perforated card with full instructions for assembly and use. At your hi-fi dealer, or send 20 cents to cover handling and mailing to Shure Brothers, 222 Hartrey Ave., Evanston, Ill.

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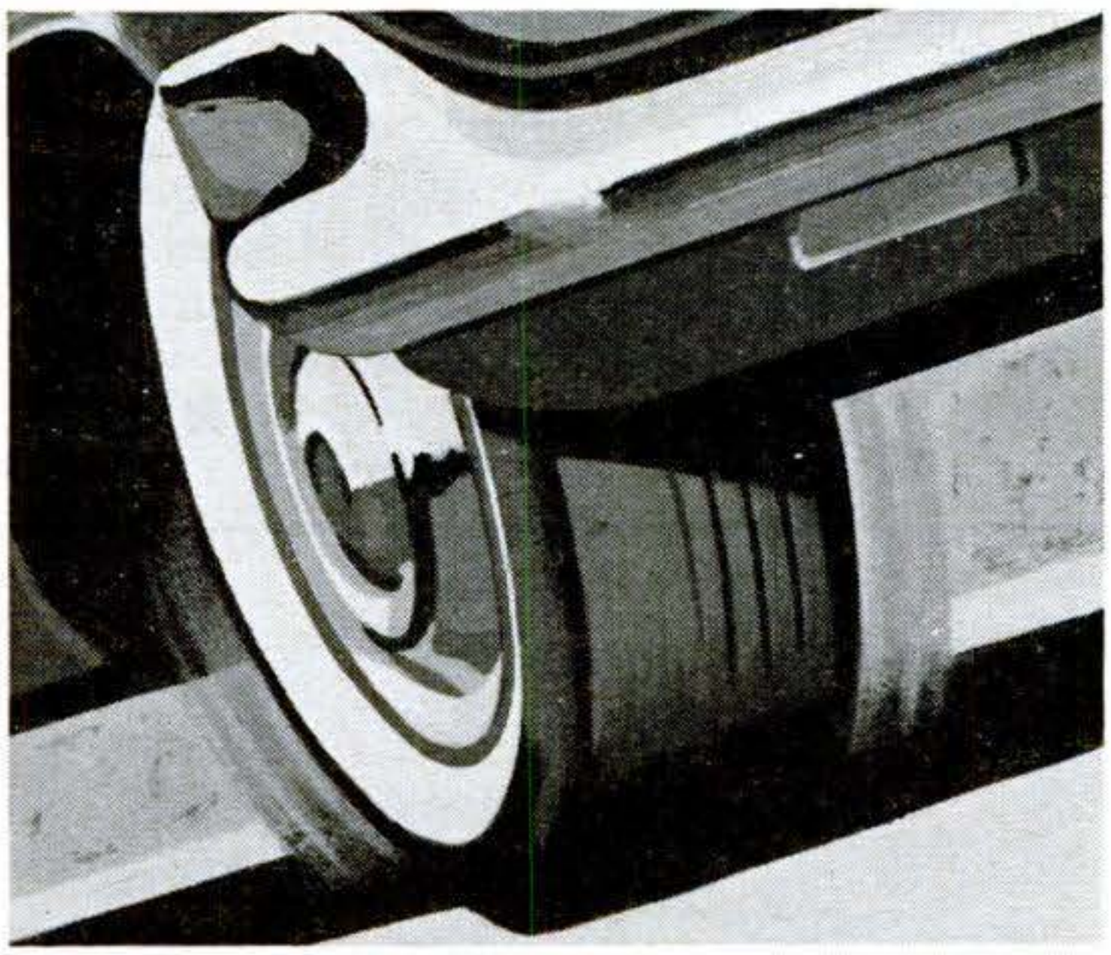
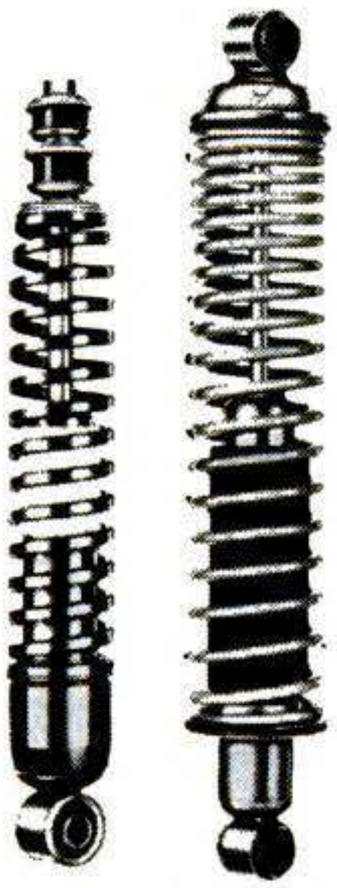
Monroe *FRONT* and *REAR* Load-Leveler®
stabilizing units

END THESE HIDDEN DRIVING DANGERS



FRONT-END SAG? Sagging springs throw wheels out of line, cause shimmy, fast tire wear, loss of car control. Front Load-Leveler stabilizing units end these hidden dangers and make your car ride like new.

TAIL DRAG? Even with loaded trunk and rear seat passengers, car remains on safe, stable keel with rear Load-Leveler stabilizing units. Swaying on curves and bottoming on bumps is ended.



Your car's suspension system is an often unsuspected source of danger when shock absorbers wear out or are put to heavier use than they're designed for. Eliminate this danger—and enjoy a more comfortable ride—with Monroe rear Load-Levelers and the New Monroe front Load-Leveler stabilizing units.

Have Monroe Load-Levelers installed today where you have your car serviced. Look for the yellow and blue Monroe demonstrator barrel.

MONROE

World's largest maker of ride control products including Monro-Matic® shock absorbers

MONROE AUTO EQUIPMENT COMPANY • Monroe, Michigan

In Canada, MONROE-ACME, LTD., Toronto, Ontario • In Mexico, MEX-PAR, Box 28154, Mexico City

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[Continued from page 110]

length can be center-drilled and supported between the lathe's centers. A lathe dog, a clamped-on device that engages a slot in a faceplate screwed on the spindle, revolves the work.

The chucks. Usually work to be machined is most conveniently held in a chuck. There are several kinds: four-jaw chucks, three-jaw chucks, Jacob's-type chucks, and draw-in collets. Wisest choice, if you can afford only one chuck, is the independent four-jaw, which, since it will grip either round or odd-shaped work securely, is undoubtedly the single most useful lathe accessory.

Often irregularly shaped work can simply be bolted to a faceplate with tapped holes, either directly or with some combination of bolted-on angle plates, studs, parallels, U clamps, or other holding fixtures.

The bits. Like cold chisels, a metal lathe's tool bits are sharpened to 60- 80-degree cutting edges. Their cutting action is really a deep scrape—they bulldoze off a curled chip.

The bits are ground for particular kinds of cuts. The machinist uses an angle-faced bit sharpened on its left-hand edge, for example, to make heavy, roughing-to-size cuts that progress from right to left. For cuts progressing from left to right, he switches to a similar bit with its right edge sharpened. For a facing cut, he'll change to a right-hand or left-hand facing tool. When he wants a smoothly turned finish he'll generally use a round-nose finishing tool.

Experience has shown that tools ground to fairly standard rake and clearance angles work best. You'll find recommended angles for many kinds of tools diagramed in any machinist's handbook. A set of ready-ground bits—handy for reference—costs about $3.

There are a variety of accessory toolholders with specially ground tools that simplify such jobs as boring, cutting-off, brass-turning, and forming.

And a number of attachments designed for particular machining operations are available. Two are especially useful: a milling vise, which mounts on the tool post and feeds work into a milling cutter chucked in the spindle; and a tool-post grinder, which puts a precision-ground finish on any turned steel. Many home-shop machinists rig tool-post grinders from small universal vacuum-cleaner motors.

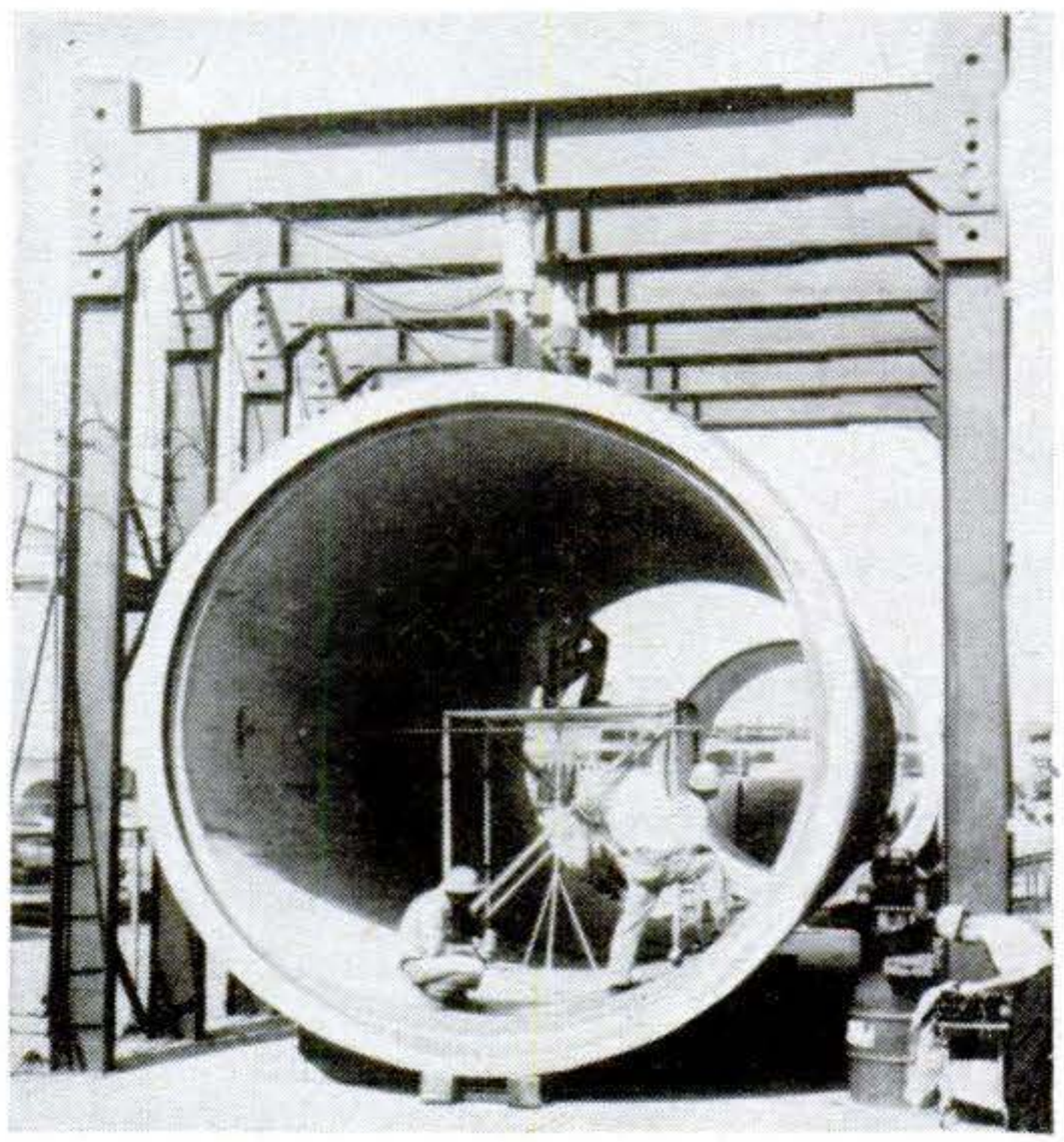
A warning. There are a few precautions to remember when using a lathe. Safety is largely a matter of keeping your mind on what you're doing.

Don't reach for a lathe dog before the spindle stops—lathe dogs can bite. Never leave the key in a chuck. Don't over-oil a chuck, or you'll get an eyeful of black spray when you start the lathe. Wear protective glasses when grinding or when turning work that spews small chips. Don't wear sleeves or neckties that can get wound up in the machine.

It pays, since you'll be protecting your investment in the tool, to maintain your lathe conscientiously, oiling the many bearings, gears, and other wear points each time the machine is used, and cleaning up chips and wiping the ways after use.

Acquiring a lathe is a long first step into the whole broad and fascinating field of metalwork—heat-treating, tool design, patternmaking, and all the other allied specialties. When you own one you'll have a worthwhile tool with unlimited interesting possibilities. ■ ■

Giant load-testing machine



Six rams on the crossbeams of this testing machine exert a combined pressure of 900 tons. The device, built by American Pipe and Construction Co., South Gate, Calif., tests the strength of concrete pipe 18 feet in diameter and structural members up to 70 feet long. The rams can be fitted to various shapes.

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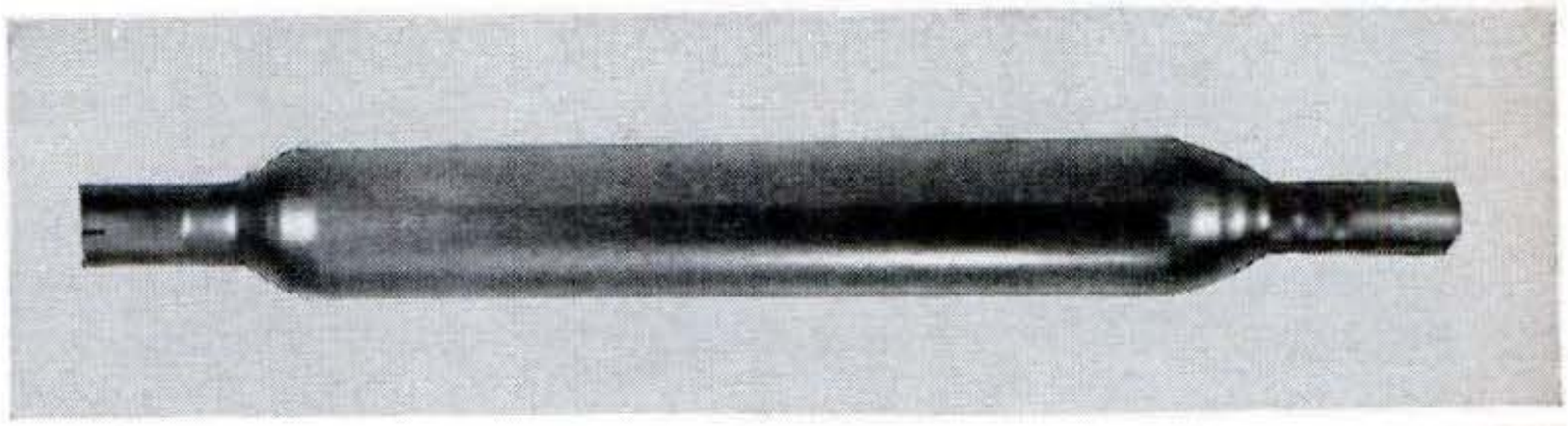

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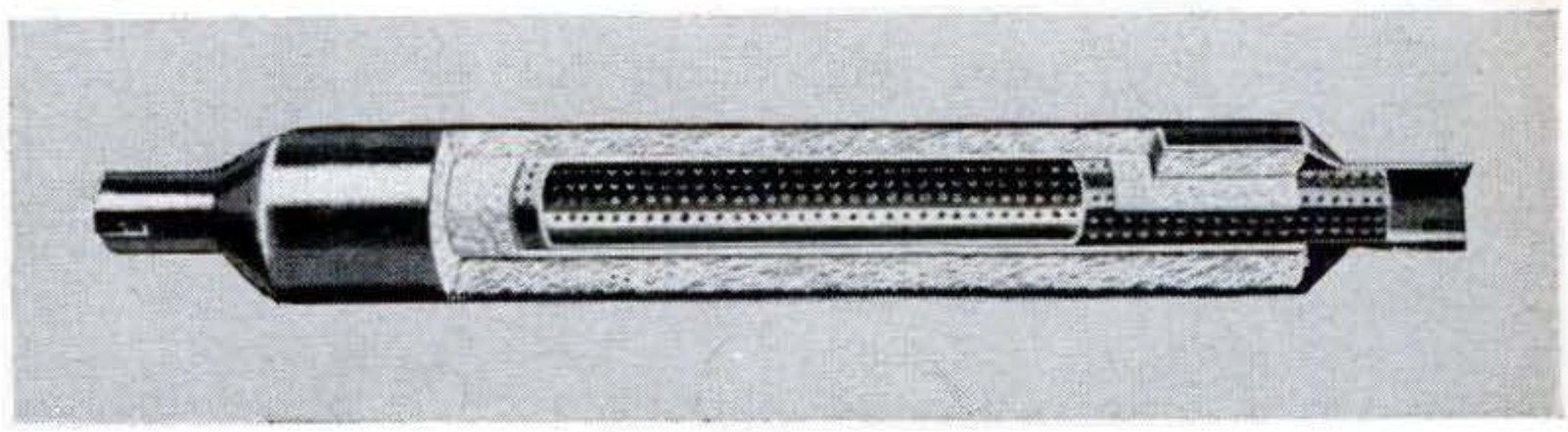

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[Continued from page 101]

minute—for each gun—as high as the highest slope that is to be "snowed." When the lift is high, there are relay pumps, each with its own electric motor or diesel engine. This supply of water is carried up through aluminum pipes (just like those used in irrigation).

The air compressors—which may run $15,000 each and number five or more—are usually rented. They must deliver air to the guns at a rate of 100 to 125 cubic feet a minute and at a pressure of about 100 pounds per square inch. The delivery pipes are the same as for water, and normally are laid side by side.

Every 40 to 50 feet there are outlets for high-pressure rubber hoses long enough to reach across the slope—usually 100 to 200 feet.

The whole thing must be laid out so that, ideally, it drains to the bottom when it is not in use—or so that any low spots in the lines can be drained individually and very quickly once the flow of water has been shut off.

The number of guns depends on the size of the hill, the speed with which you want to snow it, the specific need (regular use or merely grooming of the slopes), and the night temperature you can count on, because the colder it is, the more snow you can make per minute. On small slopes, a setup at the bottom snows half the hill. Then the crews take the guns up to the second station to snow the other half. With temperatures in the twenties, two or three moves are possible, with four to six inches at each setup.

Tony Wise, blowing snow through 24 guns in a system that uses seven miles of aluminum pipe, serves weekend crowds of 2,000 with the biggest system in the world. One slope is 2,600 feet long. When running at full hum, his system has about $250,000 worth of owned and rented equipment going on 1,200 to 1,500 feet of ski run. As fast as the snow is laid, special snow tractors drag impacting rollers over it.

OVERNIGHT Tony can put down three inches of packed powder. "To most ski fans," he says, "three inches of packed powder are the five most beautiful words in the world."

In contrast to the full treatment, as Mt. Telemark gets it, there are private ski clubs that keep their own small practice slopes in enough snow with just one gun. And scores of small ski areas provide better going than their fancier neighbors, using minimum equipment.

By adjusting the flow of water in relation to air you can produce wet or dry snow as Ascutney did on its glare-ice slopes. Or you can engineer the mixture to get the best snow at any given temperature.

Consider The Homestead at Hot Springs, Va. In the winter it is too cold for comfort—but not cold enough for anything else. A few years ago it was a good winter weekend if 30 rooms were occupied. Then Dan Ingalls, The Homestead's ski-fan president, got to thinking how often it froze at night.

Today they advertise "Go South to Ski" and you can hardly tell Virginia from Vermont on the slopes. Snow machines, set to throw a fine mist on nights that aren't much below freezing, deliver a delightful fine-corn snowfall—four inches before morning. And the cry of "Track, yo' all!" is heard in Dixie—and not only in Virginia but in Gatlinburg, Tenn. (opening this winter), and Blowing Rock and Cataloochie, N.C.

HOW good is man-made snow? Experts say it's better than the stuff nature makes. It is three times as dense, so it resists the lateral pressure of the ski edges better in turns. Because of its fine texture, it packs into a firm base, while the surface stays loose. The globules are hard-frozen corn snow, not flakes, making the snow fast and resistant to thawing—and going wet—in warmish weather, which means it stays fast.

Because of man-made snow's resistance to warm spells, skiing becomes more dependable up north, too. Around Detroit, Philadelphia, Chicago, and New York, where winter is winter, there are long periods of too-warm weather. With snow machines, the New Yorker or nearby suburbanite can take his pick of several slopes with a two or three hours' ride on the turnpikes—and be sure he'll find excellent skiing. This is of great importance to the weekender who has neither the money nor the inclination to pack off to Sun Valley or Kitzbuhel, but who wants to be sure—at the end of a difficult drive over icy roads—he'll find snow on the mountain. ■ ■

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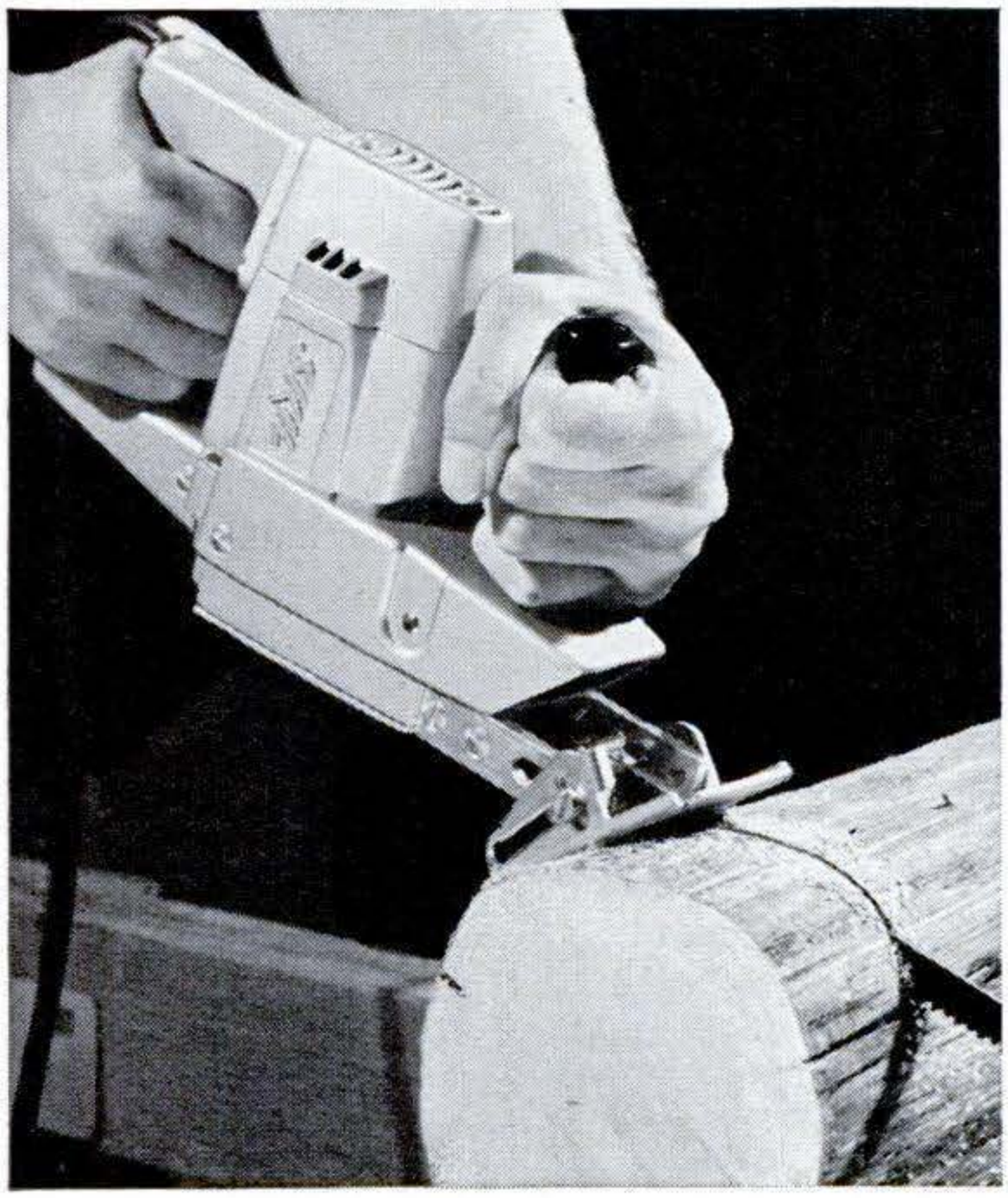
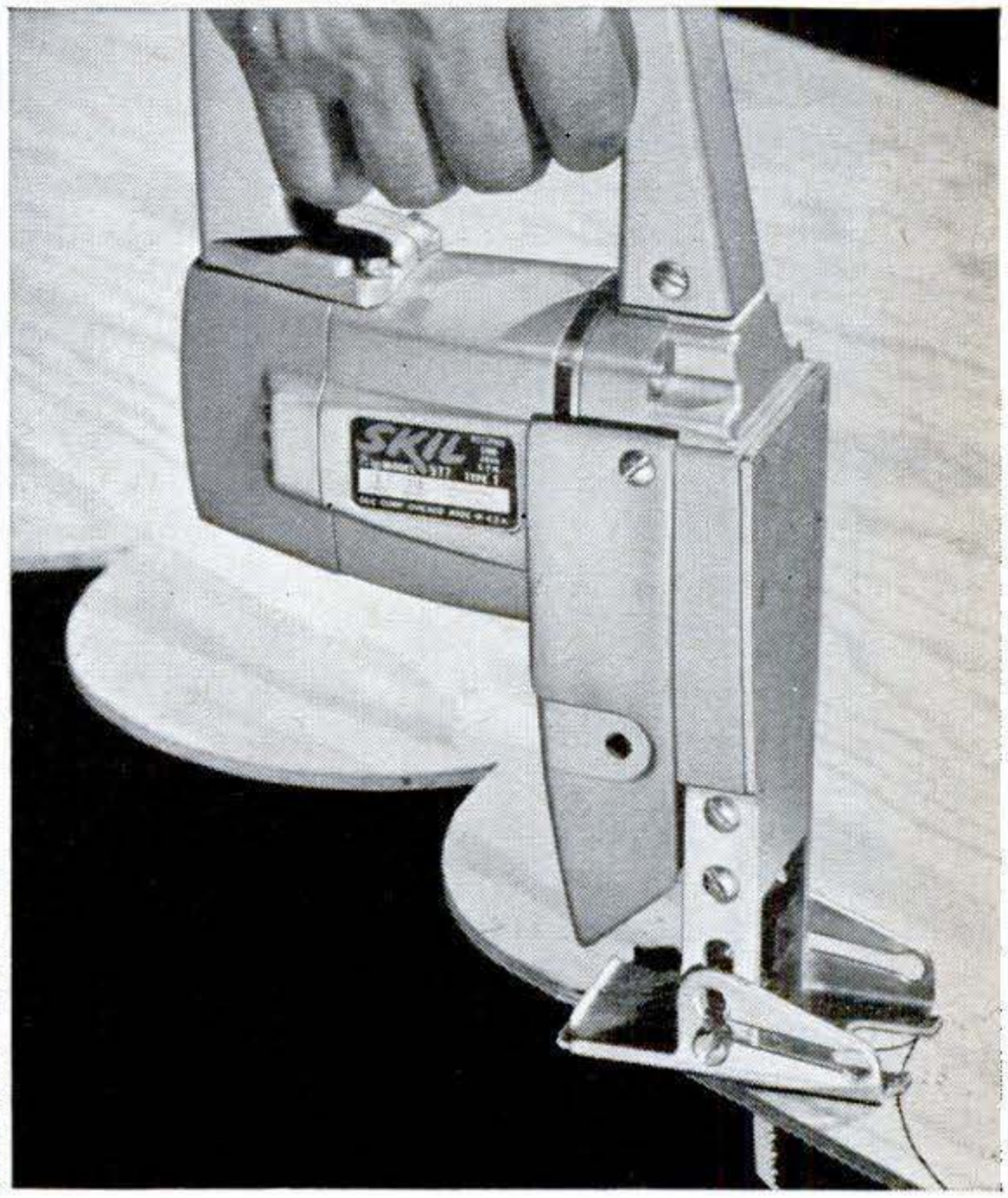
NEW KIND OF POWER SAW





Skil Recipro Saw makes <u>any</u> cut from 6″ fence posts to fancy patterns!

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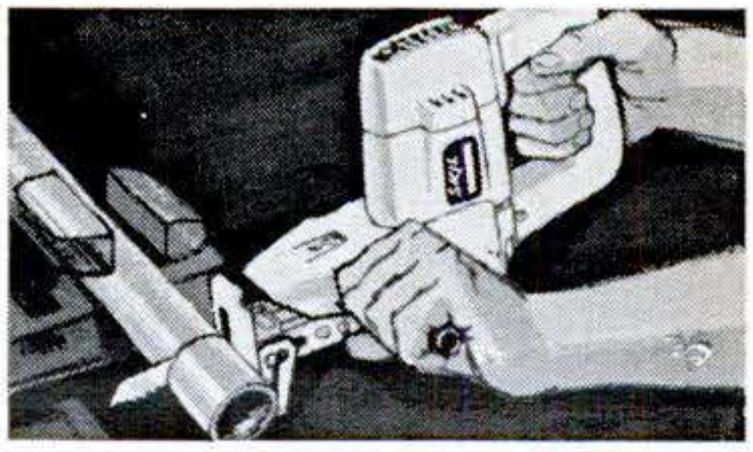
It's a coping saw, hacksaw, scroll saw, jig saw, crosscut saw and rip saw that'll make you twice the craftsman you ever thought you were! You can buy it at better hardware and lumber dealers everywhere. Priced under $50 (slightly higher in Canada).

Bevels, Miters

Cuts in Walls, Floors



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SKIL POWER TOOLS

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[Continued from page 105]

tripod. Working from a booth overlooking the speaker's platform, I was able to record every gesture and expression. In a situation like this, it's helpful to go in advance to the spot where the subject is scheduled to stand and take an exposure measurement.

The most useful accessory for available-light photography is an exposure meter. For this I prefer an incident- rather than a reflected-light meter. An incident meter, such as the Spectra or Brockway, measures the light falling on the subject. A reflected-light meter, such as the Weston, measures the light bouncing off the subject.

If there are windows or strong lights in the background, a reflected-light meter may give an inaccurate reading. Many meters have attachments for both incident and reflected light. A most useful one for work with stage light or in any area illuminated at a distance is the Heiland spot meter. I've also used it for measuring the light on a football field while shooting from high up in the press box.

A small but sturdy tripod is another useful accessory. There are many you can choose from, made by Quickset, Linhof, and others. I always try to use a tripod when exposures are longer than 1/30 second. It is a must with long lenses. The slightest vibration is magnified with telephotos, and their narrow angle of view makes a tripod useful to position the subject.

Recently, for example, I photographed the 1963 automobiles. All of these pictures were made from a portable crane, sometimes called a cherrypicker, which hoisted me 30 feet above the cars. Getting each automobile in a precise position in the composition necessitated a tripod. I used available light. At General Motors the light changed from bright sun to a rainstorm during the shooting, and exposures had to be quickly changed.

One of the biggest problems in working with available light is excessive contrast. I minimize it by using two techniques. One involves raising the level of illumination by replacing ordinary indoor lamp bulbs with No. 2 photofloods. This maintains the existing, natural effect, but makes it possible to expose at higher speeds, stop action more effectively, and get more light into shadow areas.

Another simple device is a homemade reflector. I make use of anything that will bounce light back at the subject and illuminate the shadows—either indoors or outdoors. I have made reflectors from sheets of aluminum cooking foil, newspapers, bedsheets, and tablecloths. On close-ups, even my white shirt helps lighten shadow areas.

Excessive contrast can also be controlled through exposure and development. Longer exposures in black and white produce more shadow detail; longer development produces greater contrast. Prolonged development increases grain, blocking up the highlight areas. Extreme underexposure usually can't be corrected satisfactorily.

A few tricks are worth remembering. When you start working with available light, use one film-and-developer combination until you have explored its potentials fully. If you do your own processing, you may find Tri-X, used at ASA 400 and developed in D76, is a good combination. It has ample speed for a low-light situation and minimizes contrast.

In color, I suggest High Speed Ektachrome at 125 indoors. To shoot color outdoors, where the light is usually better. add an 85B filter and use an index of 80. You then will require only one film for all available-light situations.

To perfect your available-light technique, there's an instructive exercise you can follow. As you go from one location to another, guess the exposures. Then check your guesses against a meter. If you stay with one film, you'll soon be skillful at estimating exposures under a variety of conditions. This makes it easier and faster to make natural and unposed pictures.

Finally, study the photographs in newspapers and magazines, especially the latter. Most photojournalists use available light. Analyze the lighting angles and figure out how you would have done it.

The ultimate purpose of available-light photography should not be forgotten. It is to make the camera an extension of the eye so that what we see we can photograph precisely.

The technique must be used by the photographer, not as a magic, mechanical formula, but rather to create more-honest, believable photographs. It is not lighting, camera, film, or lens that are important, but rather the mind of the photographer, who has a point of view about what he sees—and captures it on film. ■ ■

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P&C

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[Continued from page 63]

(commonly called a potentiometer). The varying pressure then presents itself in the analogous form of a varying voltage, which can be radioed to earth.

Other data can be obtained most conveniently in digital form. For example, the speed of rotation of a rocket turbopump can be measured with a simple slip-ring contact, which feeds one electric pulse into the telemeter transmitter for every revolution of the pump shaft. It is easy to see that there will be no loss in accuracy whatever if, on the ground, the chain of incoming electric pulses drives a digital-display unit like the odometer in your car.

There is a third situation, however, and this is where analog-digital conversion systems come in: Suppose we want to telemeter to the ground with extreme accuracy, during flight, the steering movements of a hydraulic actuator that deflects a rocket engine. We could equip the piston of the actuator, just like that tank manometer, with a potentiometer and radio the resulting voltage changes to the ground. This, of course, would be an analog method. The accuracy attainable would be limited by the wire thickness of the potentiometer, and by inherent difficulties in telemetering voltage readings precisely.

Turning "analog" into "digital"

We can do better by converting the "analog" movement of the piston into a digital readout. For instance, we can rig up a system so that the piston, through a high gear ratio, will rotate a slip-ring contact like the one on the turbopump. Instead of a varying voltage, we now can radio a chain of discrete pulses to the ground—with a resulting gain in accuracy for the whole data-transmission system.

Probably the simplest analog-digital conversion system is your dial telephone. The angle between your finger and the stop, before you spin the dial, may be compared with an "analog" needle deflection we may want to transmit. But all the transmission lines ever see is a chain of electrical pulses containing the information in digital form.

Q ***Why are lunar and planetary rockets put in "parking orbits"?***

A From the point of view of celestial mechanics, a rocket could be launched

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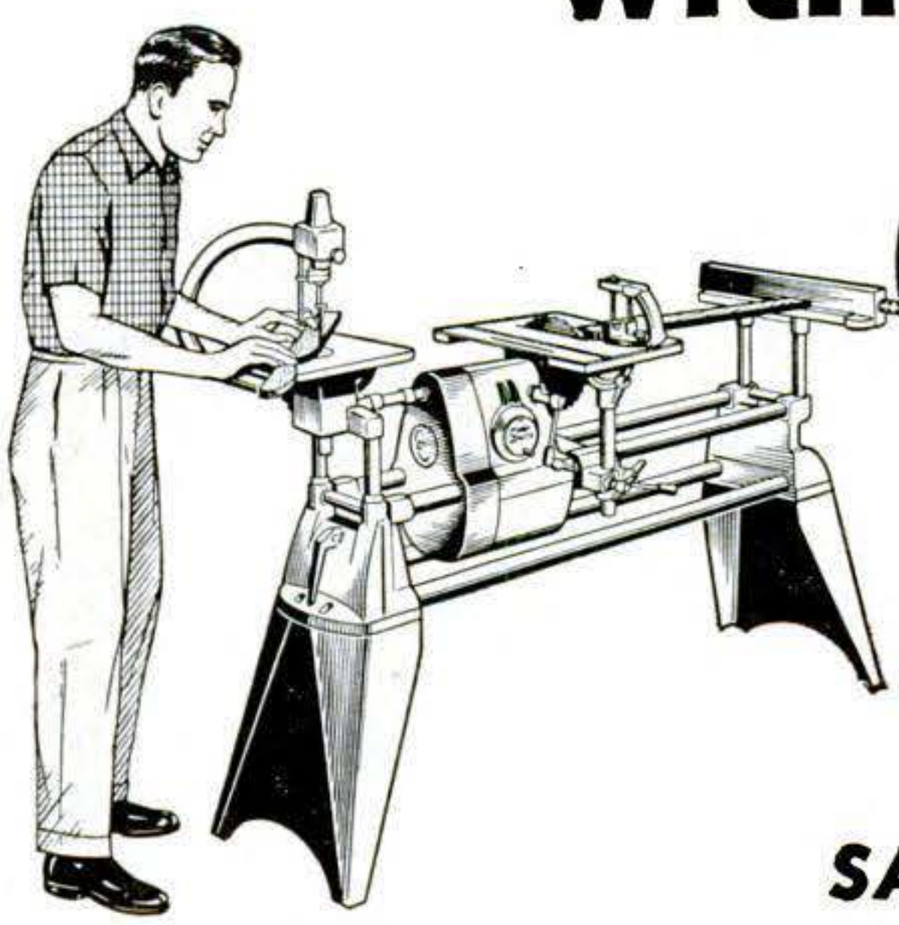

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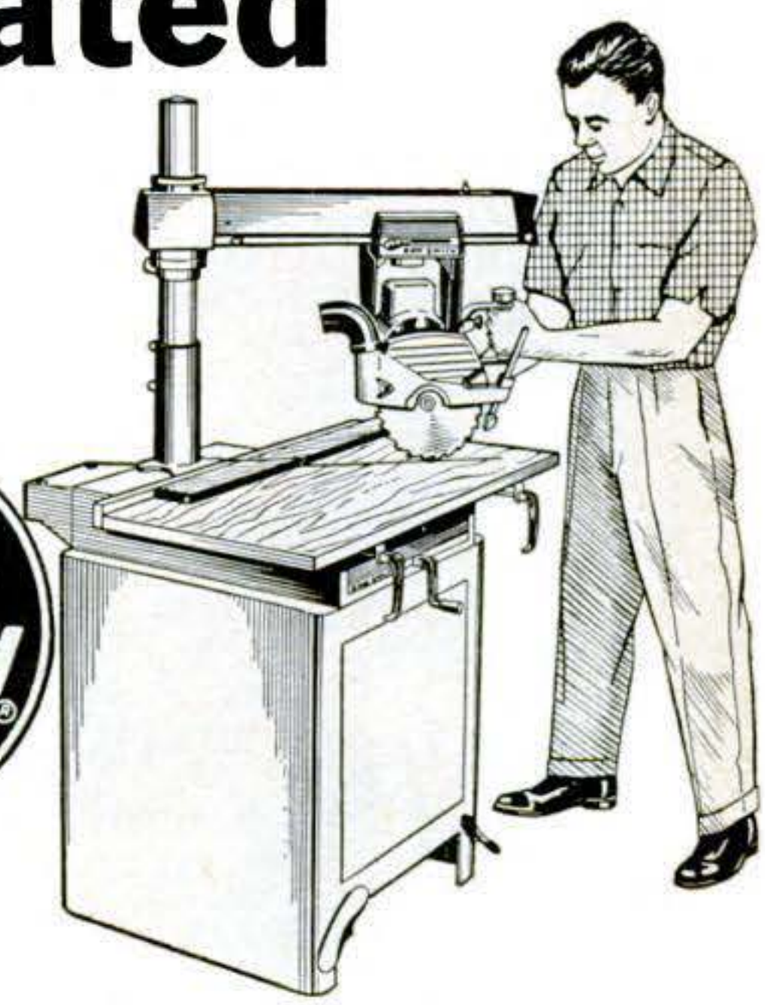

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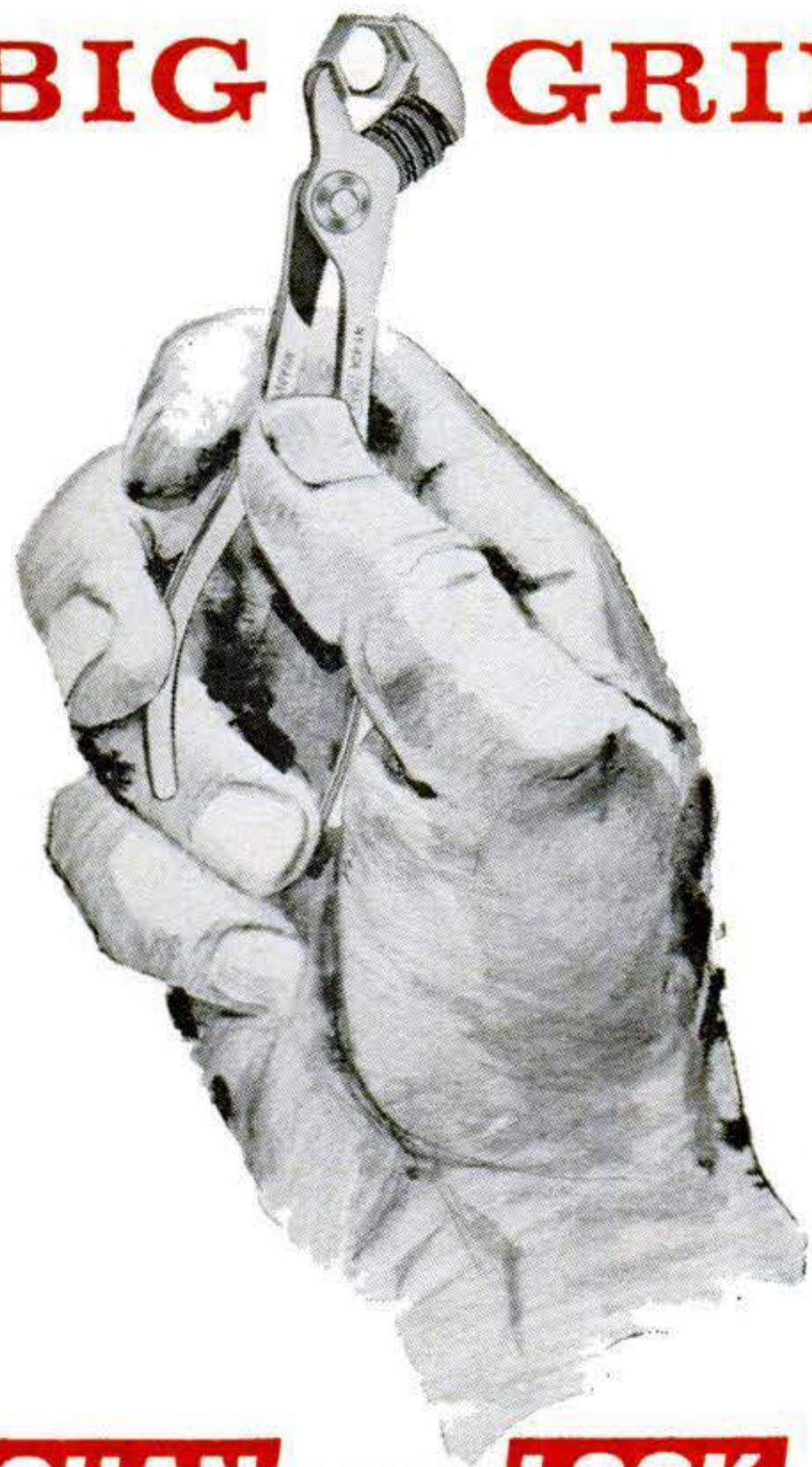
BIG GRIP



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from any point on earth *directly* to the moon or any planet. Placing the rocket temporarily in a parking orbit (around the earth), first, is solely for convenience in carrying out the operation. It greatly widens the "launch window," the time span during which the launch may be executed.

Take a launching from Cape Canaveral to the moon. The Cape whirls around the earth's axis once in 24 hours, while the moon orbits the earth about once a month. Hence the task of hitting the moon can be compared with that of shooting a running rabbit from a revolving merry-go-round. Your "firing window" is short—you can fire only during the brief interval when the rabbit is in sight. Next time around, your aim must change, because the rabbit has moved on.

Now, it is still a rather tricky business to get a complex multistage rocket off its launch pad at precisely the right instant. It would be very awkward indeed if the whole complicated set of earth-to-moon guidance instructions had to be changed, just because the zero time was missed by only a few seconds.

Where precise timing counts

From the vantage point of the lunar target, however, it can be seen that there is only one point of the trajectory at which precise timing is really critical. That is where the rocket enters its long, unpowered "transfer" path to the moon—the so-called "translunar injection point."

A parking orbit divides the earth-to-moon journey into two distinctly separate phases of powered flight: the launch-to-orbit portion and the orbit-to-lunar-injection part. The rocket's "stay time" in the parking orbit, until the right moment comes to start it on the second phase of its flight to the moon, may be a few minutes or several hours.

Thus a parking orbit provides desirable slack between the "flexible" or possibly unpredictable timing of the ground launching, and the "frozen" timing for translunar injection. ■ ■

Dr. von Braun will consider answering questions from readers of POPULAR SCIENCE in the magazine, but he cannot undertake to answer each one by mail. Letters to him should be addressed in care of POPULAR SCIENCE, 355 Lexington Ave., New York 17, N. Y.

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THE COLUMBUS PARTS CORPORATION

1801 Spielbusch Avenue, Toledo 1, Ohio

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[Continued from page 122]

Teamed up with a high-rise Shakespeare fiber-glass antenna, this radio has a long reach.

Next to the radio-telephone is the Heath radio direction finder. This comes in kit form or factory-assembled. My son Jim has assembled several of these, and they have worked uniformly well. This set operates on three bands, pulls in short-wave and standard broadcasts, and the long-wave FAA weather broadcasts.

Handy aboard any twin-engine craft is a pair of tachometers such as the Heath electronic models lying beside the RDF. These help you keep both engines working as a team. Final members of the ship's company are a matched set of Airguide instruments—a compass on the dash and a barometer, clock, and speedometer mounted on the binnacle box.

A runabout for thrills. This sleek 14-foot Traveler is a fine family fun boat for skiing, picnicking, or doing exciting maneuvers. We chose an Ansul dry-chemical fire extinguisher because of its handy size and its neat portable hang-up rack—ideal for limited space in a small boat. It also comes with a spare charge.

A Johnson 40-hp. outboard, one of the most dependable power plants made, gives the planing hull good speed. Johnson remote controls handle the shift and throttle. A Navionics modular instrument panel provides complete instrumentation.

For long cruises between gas stops, we decided to install Edward Can Co. built-in gas tanks—a real advantage even in a small boat. For greater family safety, we also chose a Sonar radio-telephone—not a luxury if you go dashing about far offshore.

A patio on pontoons. This Kayot pontoon boat, with its 28 feet of length, gives you room to haul the whole gang. For their enjoyment is Sony's tiny new TV set [see Jan. PS]. The smallest set in the world, it will operate from its own battery pack, making it ideal for small-boat use. Or you can plug it into the boat's 12-volt system.

If your gang is not all assembled, you can give them a hail with the Cub hailer. It has power enough to lift a sleeping friend right out of his shoreside deck chair. We've chosen EEz-In folding tables and chairs for this boat because they are ruggedly built, yet stow in a small space.

At the stern is a strong Scott 28-hp. motor, ample to send this floating patio across the lake at a spanking speed. And at the bow is one of the slickest diving boards ever designed. This Witmer board is spring-loaded and counterbalanced. It's short in length but long in performance.

Day sailer for a family outing. Ray Greene's Rebel is one of America's finest day sailers. Of fiber-glass, with built-in flotation, this 16-foot boat is big enough for whole-family enjoyment, yet small enough to trail behind your car. It's a beamy, stable, centerboard craft with a sail area of 166 square feet. It can be rigged with a spinnaker.

Aboard the Rebel we've put a comfortable Tapatco sleeping bag forward so crew members can nap from time to time. Life jackets are an essential, and we have a full supply of Red Heads on hand. A portable Radar-Lite is a handy spotlight, and at night its beam can be directed upward at the sails to warn other boats away.

Since wind is a fickle commodity, we made sure to have a three-hp. Evinrude on board. It will bring you home when the wind deserts you and help you maneuver to or from a dock. And for a dry sail, even when the spray is flying, we've outfitted the crew with Sperry's foul-weather gear and TopSider skidproof shoes.

For big water, a 30-footer. The Pacemaker is one of the most seaworthy boats built. Properly equipped, she's a good craft for extended offshore cruising or for living aboard. Our 30-foot boat is powered with twin 185-hp. Pacemaker engines and boasts an array of cockpit and cabin equipment that will make every boatman want to come aboard and look her over.

Tucked down low at the port side is a White automatic pilot. This will hold the cruiser on a set course for long stretches over open water. A precise Bendix depth sounder is aboard, warning of shoal water. Slung to the overhead, too, is a 90-watt Pearce-Simpson radio-telephone to keep the Pacemaker safely in touch with shore.

Center-mounted on the dash is the new DF-O-Matic automatic direction finder. This is a particularly fine instrument for offshore, all-weather cruising. It eliminates computations, giving the boat operator a to-from reading and a left-right indication automatically. It operates on its own battery pack or can be plugged into 110 volts when

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Apache Chief, $525 F.O.B. Lapeer, Michigan

"Coffee ready yet?"

Want to see something fast? Watch this . . .

An Apache Chief is up even before you add the chicory (takes about 8 minutes). With built-in double bed and foam mattress. Over 45 cu. feet of storage. Two big picture windows with nylon screening and zippered storm flaps. Draft-free, sewn-in flooring. Vivatex-treated Army duck tenting! . . . How's that for speed?

With an Apache in tow, you cruise at normal highway speeds (bon voyage). Lightweight aluminum makes it easy to move, hard to rust. There are off-the-ground Apaches and on-the-ground Apaches, from $395 Scout to $645 Eagle. They're the fastest-up, fastest-down, fastest selling camping trailers you ever saw. Your Apache dealer will help you finance one in a minute or two!

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ashore. It receives broadcast, beacon, or marine wave lengths.

On the dash, in line with the starboard windshield, is Zenith's famous nine-band Transoceanic receiver, and something new has been added—an FM band. For a cruising boat, this is a particularly welcome feature. It's a fine relaxer.

This is a fully instrumented boat. Handy to the helmsman's hand and eye are Airguide's brand-new engine-power indicators. Operating on manifold pressure, these show how to get maximum power and life from a boat's engines. They are marked off in inches of vacuum and labeled as to areas of economy cruise power, high-speed cruise, and emergency short-period-only. These instruments can warn of engine difficulties before they become expensive repair jobs.

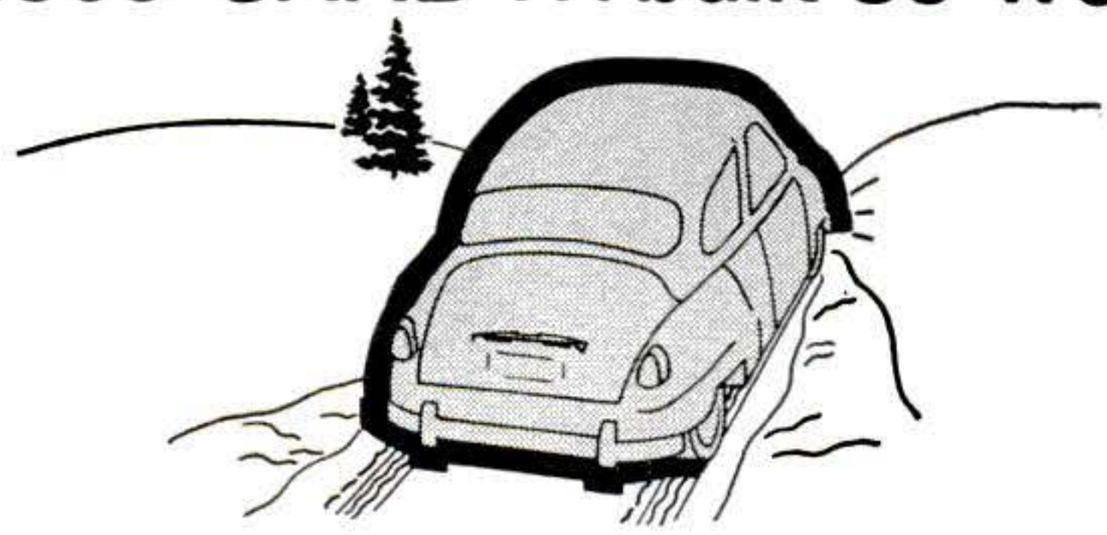
Teamed up with the engine-power meters are a pair of Ongaro fuel-flow meters. These are connected to flow sensors in the fuel lines and give a constant indication of the gallons per hour each engine is using. Dependable Morse controls give positive engine control, and a Half-Mile Ray spotlight mounted atop the hardtop will help you find your way into a tricky channel at night. For convenience, an Airguide barometer and clock are on the starboard bulkhead.

Inside the cabin, the Pacemaker boasts an electric stove, electric refrigerator, and electric cabin heater. Also there's a gimbals-mounted Primus stove from the Crow's Nest, designed to keep the coffee not only hot but in the pot no matter how great the angle of heel or how rough the seas. Since all the electric equipment aboard puts a high demand on the batteries, there's an Onan light plant beneath the deck.

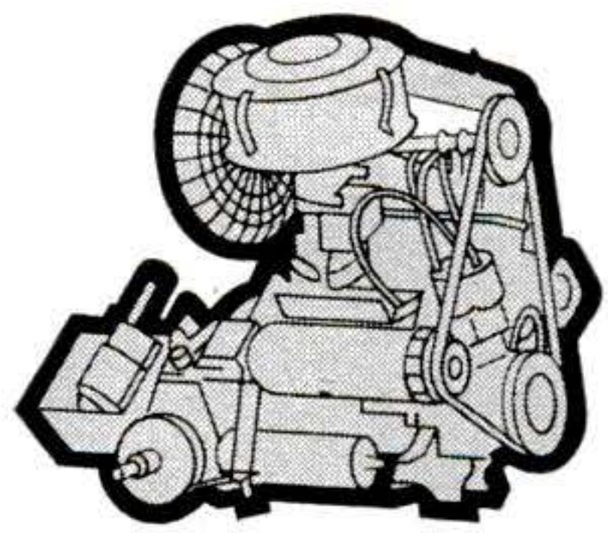
A roomy outdrive. Here's a boat—the Chris-Craft-Thompson 20-foot outdrive—that's so roomy, beamy, and seaworthy it adapts itself to a wide variety of activities and equipment. It's a fine fishing boat, a good base of operations for Scuba divers, and, as the photo proves, a perfect spot for a pretty girl to do a bit of sunbathing. The 100-hp. Volvo with Transdrive outdrive gives the boat real authority.

For extended cruising in rough waters, we've put aboard a Sperry radio direction finder, a Raytheon Fathometer depth sounder, and a Raytheon radio-telephone. And the most welcome item aboard at mealtimes is the Galley-Fridge self-powered portable refrigerator. ■ ■

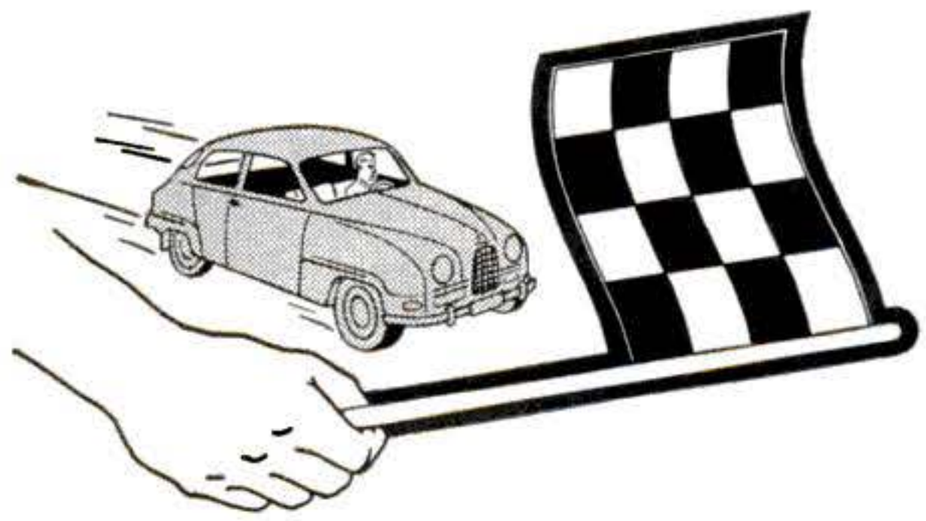
1963 SAAB . . . built so well



SAAB FRONT WHEEL DRIVE transmits engine torque directly to front wheels to pull the car firmly along narrow winding roads, around corners, and over icy, wet, or muddy stretches. Self-centering action of front wheel drive and calculated understeering ensures immediate recovery from skids, makes SAAB safer to drive in any weather and on any road. Bonus: Since SAAB transmission and differential are up front, you need no driveshaft to the rear wheels. You get more floorspace and trunk room.



SAAB TWO-CYCLE ENGINE, an economical, quiet three-cylinder, two-stroke valveless unit, employs Schnürle principle of charging through the crankcase. With every stroke a power stroke, it is comparable to a conventional "6" in pickup, hill climbing acceleration, fast cruising speeds—and offers fuel economy ranging from 30 to 35 miles per gallon. Engine dependability has been proved—in competitive victories and by the many SAABs which have provided low-maintenance performance past the 100,000-mile mark.



SAAB RALLY VICTORIES are the ultimate proof of performance, and Monte Carlo 1962 was no exception. Here again, SAAB won by outrunning and outperforming more powerful cars. Reasons: gas turbine-like efficiency at high speeds, road-hugging traction for fast swayproof turns, low steering factor (2¼ turns lock-to-lock) for maximum responsiveness. This unique combination of characteristics makes SAAB ultraroadable in any driving situation . . . turnpike, traffic, competition, back road, even parking.

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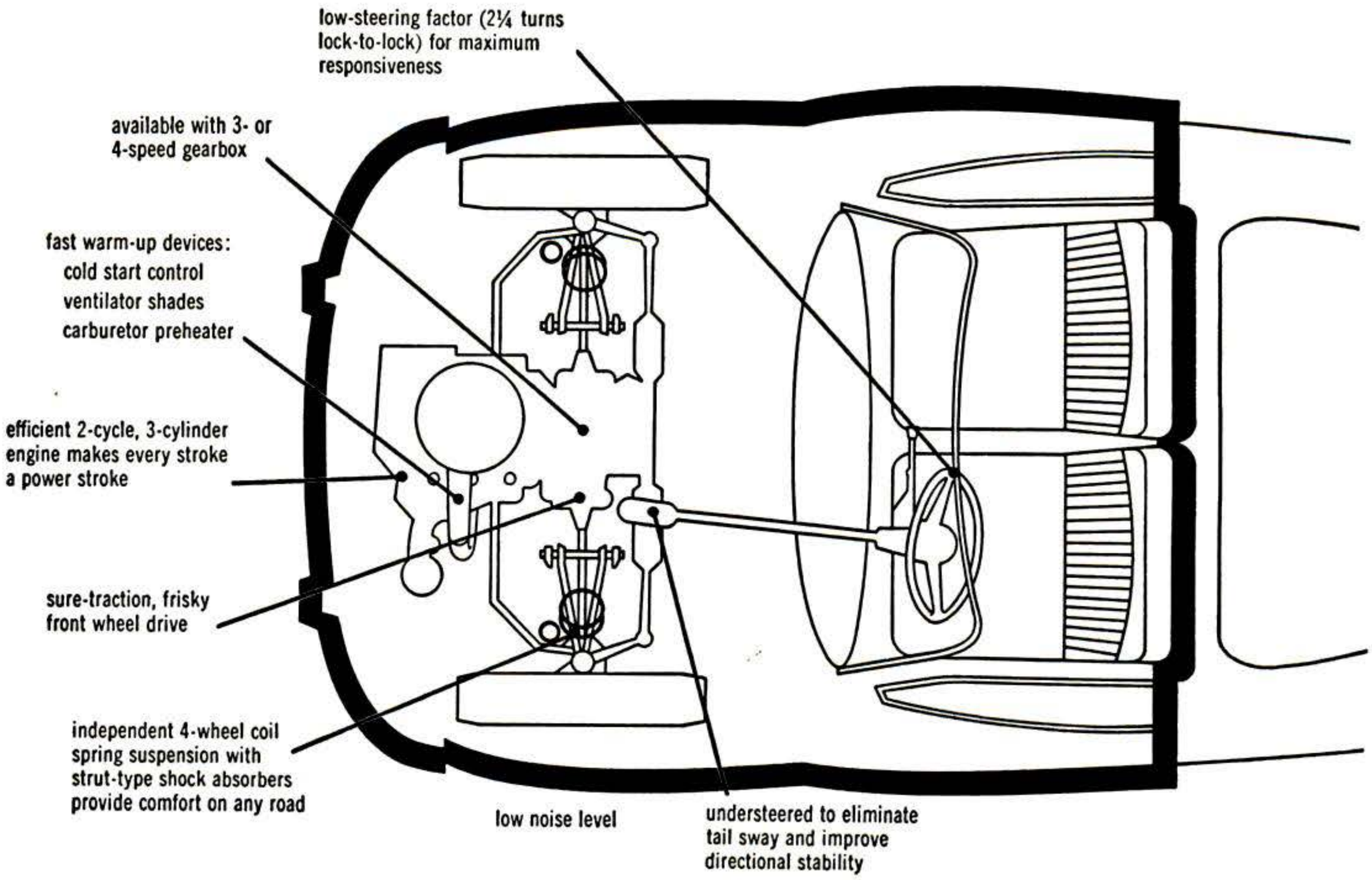
that it has a 24,000-mile/24-month written warranty*



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*Engine, transmission and differential have a written warranty for 2 years or 24,000 miles.

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[Continued from page 88]

Here, Oscar's return is checked for name, address, account number or Social Security number (and if you don't have one now you'll soon be given one), and signature. Last year, 62 percent of individual returns had unfilled blanks that would cause foul-ups with computers.

If Oscar enclosed a check, it is popped into the IRS bank account first thing, needless to say.

Off to the Atlanta Regional Service Center now goes Oscar's return. Here Oscar Farley ceases to be; he changes, under the IRS numbers game, to 192-18-9505, his Social Security number. (Machines can't digest names so well; there are 26 characters but only 10 digits. Besides, there may be a number of Oscar Farleys around; there's only one 192-18-9505.)

In the Service Center, a clerical worker transcribes 192-18-9505's forms to IBM punch cards. Each card has space for 10 rows of holes, 80 columns across. The first nine columns (on each card, if there are more than one) are taken up by the Social Security number. For a cross check—in case there's a transcription error—the first four letters of Oscar's last name, "Farl," also are punched out. The remainder of the card is punched to code such things as income, last year's tax, deductions, etc. As many as 12 cards might be needed for one return.

Oscar's card is then fed into a type 1401 computer—sort of a satellite of 7074 at Martinsburg—which transfers the record to tape, along with those of several thousand other taxpayers whose forms came in the morning mail. At the same time 1401 is memorizing this data, it whisks through the arithmetic. If things don't add up right, 1401 catches the discrepancy—but Oscar isn't told about it yet. The computer merely notes it on the tape for Big Brother to spot later in Martinsburg.

When the reel containing Oscar and all the others is filled, it's flown to Martinsburg. About once a week, all the reels that have come in are shoved into 7074's maw to be arranged in numerical order.

Next step: posting. If there's any hanky-panky about Oscar's return, here's where it'll be exposed. A master tape containing his permanent record is snapped on one part of the machine, the reel containing his current return snapped on another part, and quick as a snit the two are compared—the temporary data being transferred to Oscar's permanent record.

At the same time, the computer will make a quick check with whatever Oscar's employer (or employers, if he's been moonlighting) has reported, will note what lathe operators are *likely* to make, will scan for any stock dividends unreported, and sniff around for anything else funny—like an extra wife or a three-year-old child born during the year.

While this prying is going on (at eye-blink speed), various data will be transferred to other tapes—some to go back to the regional center, some to a Treasury disbursing office.

This latter tape is beneficial; it is translated into refund checks, after an audit to see that no money is owed from other years. (Some 36 million persons get refunds.)

Catching refund cheats. And, by the way, this is the first time that refund figures will be checked against a master file. No more of such wide-spread practices as wives and husbands filing separate returns—she under her maiden name—and each claiming the other as a dependent.

The other tapes—the ones going back to Atlanta—aren't so favorable to Oscar. When they're fed into 1401, out clatter mechanical letters at the rate of 600 lines per minute asking for more money, wanting more information, or—woe, woe—suggesting to the Atlanta agents that they ask old Oscar to come in for a little talk about that dependent named Spot.

In the meantime, Big 7074 automatically starts counting the days to see if Oscar answers in his allotted time. If not, it sends a magnetic note to 1401, and another letter is ground out, this one just a little nasty.

Is it worth it? This shift to automation is going to cost the government about seven million dollars extra a year. The obvious question: Will it be worth it?

Main answer is that if something isn't done soon, our tax-collection system will be swamped in paper. In 1930 just under six million returns were filed. Last year the figure was almost 100 million. By 1980, 135 million returns should flood in.

Second, until now there's been no central filing system. A guy could work half a year on the West Coast, work the other half in the East, and get refunds for low-income earnings from two different district directors.

CONTINUED

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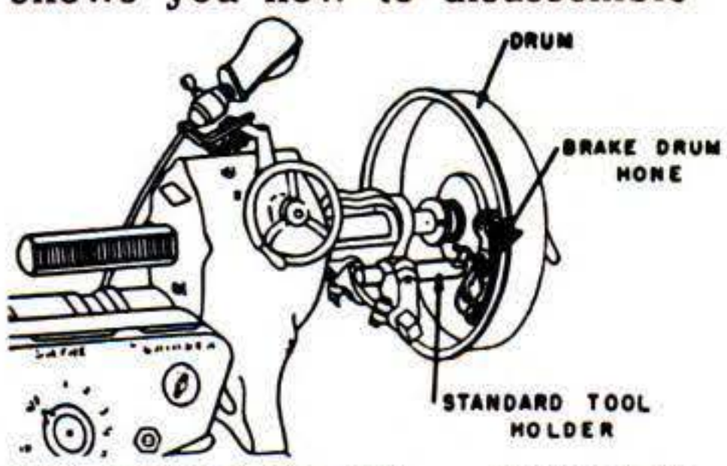

any part of the car . . . inspect it ...clean it...repair it...put it back together . . . and reinstall it on the car.

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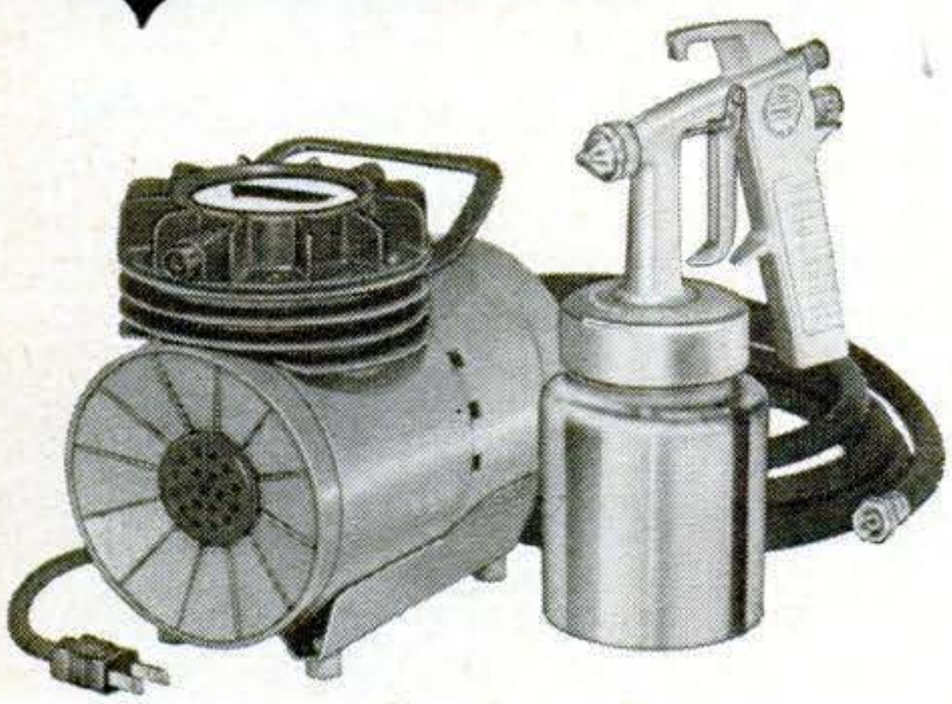

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Big-Brother 7074 Is Watching You

Now, both jobs will be on his taped record.

And in the third place, 7074 will save the government money. Tax men figure that about 62 percent of all returns actually show something less than is really owed, usually in overzealous deductions. Each year, say the authorities, people cheat to the tune of *four billion dollars* in taxes. Collect just one additional dollar of this out of every $500, and you've paid for the system.

Computers can be keyed to look for normal deductions for specific items, chuck out any that look suspicious. They're not infallible, though. Commissioner Caplin tells the story of one clerk who ran across an innocent-looking item: a woman's deduction for a swimming suit lost in heavy surf. The clerk sensed something strange, however, checked the past forms, found that the woman had claimed the same deduction the previous two years. No computer is ever going to be *that* curious.

A bigger hole in the system is that very first interminable step, the point where your writing is deciphered and keypunched to cards by hand. In each Service Center, some 600 clerical workers will be hired to punch out 50 million cards a year. Electronics companies across the country are working furiously to design a practical optical scanner—a machine to read your handwriting and transfer the data to IBM cards.

Phone hookups coming. Tax men are also looking toward the time when ordinary mail service—another time-waster—will be cut down, when the master Martinsburg machine will talk by phone to its little Service Center brothers. Right now, line-rental charges are too high.

Eventually, large corporations could also be plugged into the system. Computers thousands of miles apart could talk taxes without any numbskull human interference. Banks could be hooked in, too, reporting who is getting interest payments. Real-estate and stock-market computers might tattle on who is making money. Machines in charity organizations could reveal amounts of donations. And hospital computers could report on individual medical costs.

Of course, there's always the possibility that old 7074's plug will be put in backwards, and millions of un-looked-for refund checks will be sent to delighted taxpayers. But it isn't likely. Says Martinsburg's chief: "No system is foolproof, but we're doing our best to de-bug this thing." ■ ■

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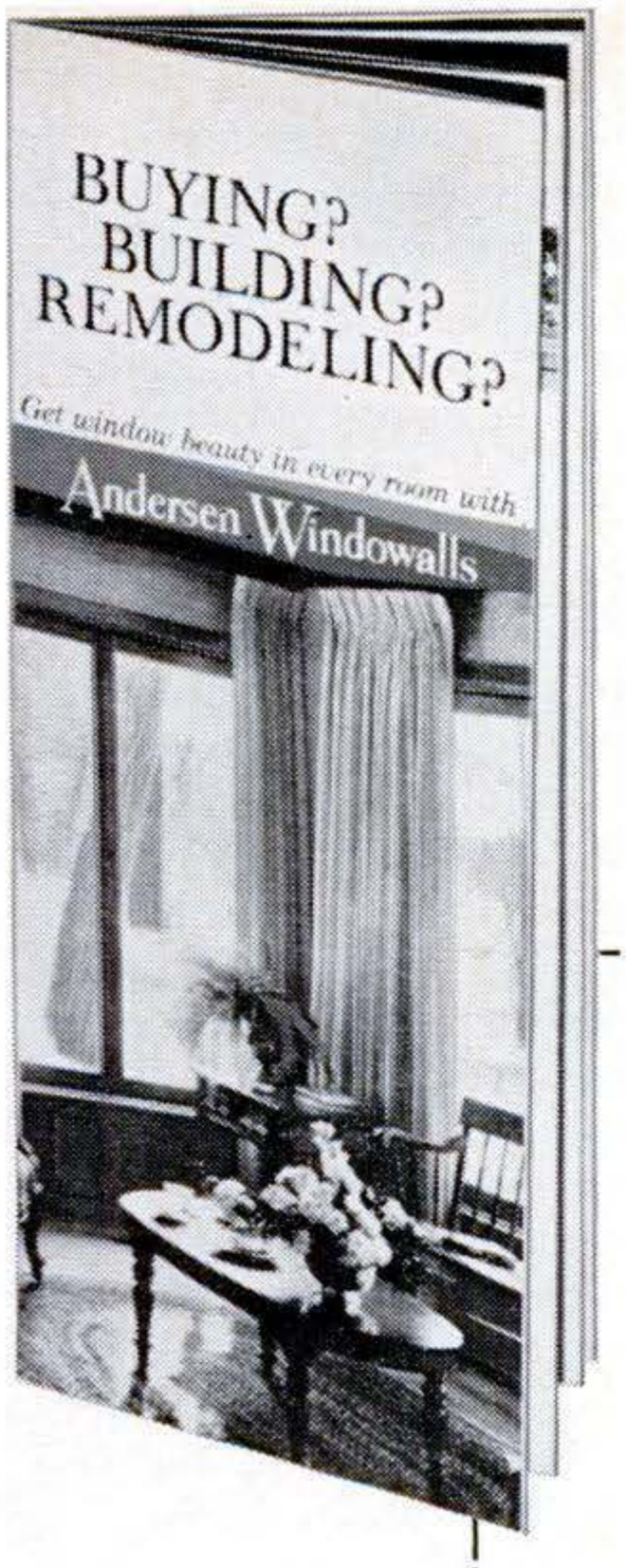

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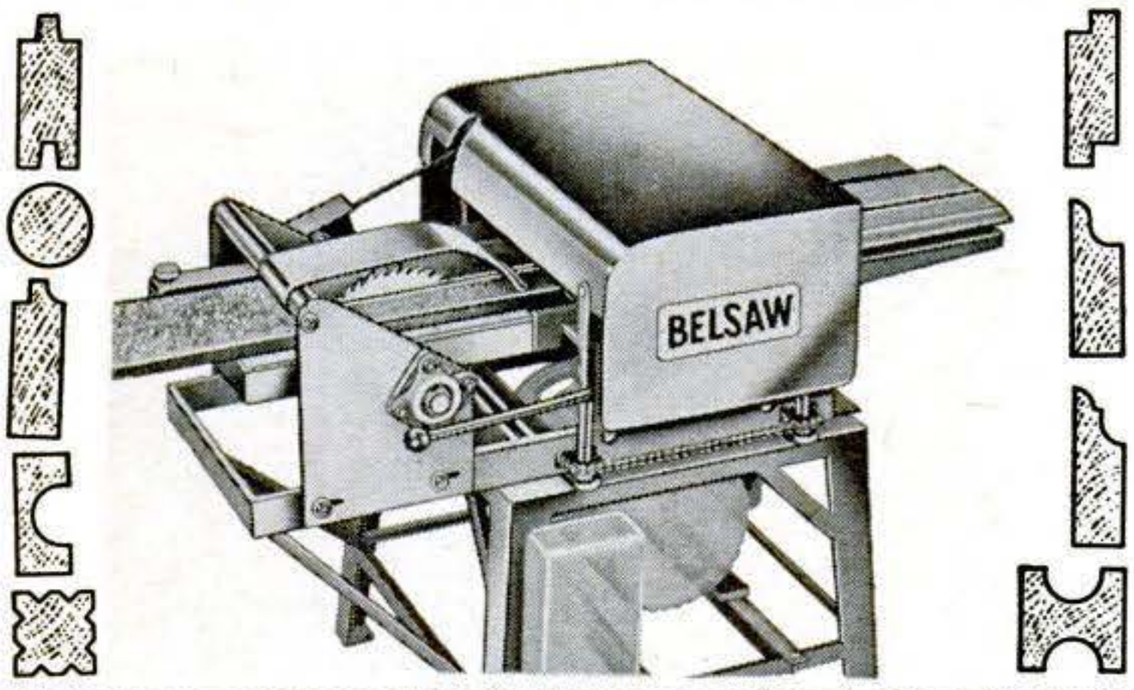

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The New Wonder Products for Boat Repairs

[*Continued from page 125*]

The slow-setting resin permeates the rotted area and stops where the less-absorbent sound wood begins. It's tacky in several days (at 70 degrees), hard in 10.

Marine borers get the same treatment, but no hole-boring is necessary. Locate the infested area, chisel off the surface to expose the start of the borer channels, and run in the Calignum. It sets rock-hard inside and kills any remaining borers.

Typical of boating's new wonder medicines, Calignum is in the high-price range: $17.25 per quart with hardener. The maker frankly advises its use only on hard-to-replace parts. Here it more than pays for itself. Used recently to impregnate a rotted section of a cruiser's keel, a single can saved a $500 professional repair job.

Leaking seams can now be cured for the life of the boat with flexible adhesive calking. The commonest is the two-part polysulfide (Thiokol) form. It not only fills the seam but bonds to the wood with a grip as high as 200 pounds per square inch. When the planking swells, the calking compresses. When planks shrink and seams widen, it stretches up to 250 percent. And it gives in any direction without letting go when seams "work" with the twisting effect of rough water. On oily woods like teak and Douglas fir, seams are precoated with a slow-drying primer that soaks in for a deep grip rather than a surface bond. (One type, Alroy 707, has primer built in.)

Unlike old-time calkings, the polysulfides limit your working time. Once the parts are *thoroughly* mixed, the calking has a pot life of from 20 minutes to about four hours, depending on brand, proportion of activator, and air temperature. The times are based on 70 degrees. The hotter the day, the shorter the time. Once set, it's actually synthetic rubber. You can sand it, but it's a tedious job on large smears; pros use masking tape on both sides of the seam.

You can mix the parts by volume or weight. Use a separate tool to spoon out each part, as even a trace carried from one to the other will spoil the leftovers. Usually the parts have two slightly different colors, so you'll know a thorough mix by the blended tone. The best mixing tool: a throwaway paint paddle.

The flexible resins. Challenging the polysulfides are the flexible resins such as Pettit's Polypoxy Calking Compound, a two-part

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rubbery epoxy available in black or white. Used to join mahogany planks with a $\frac{3}{16}''$ seam for testing, it was compressed and stretched 3,600 times. Then the wood broke. Price: $2.40 per half-pint. How far does a can of calking go? A quart fills an 80′ seam ⅛″ wide ¼″ deep.

If you discover your seam troubles for the first time after your boat is riding at her mooring, you can dodge the fuss and expense of hauling her out for repairs. Miracle Black Magic adhesive serves as a hard-setting calking that can be applied under water even to a slime-coated hull. Its petroleum-base solvent won't lift paint, and the calking will take paint when it sets. If you want to apply a flexible calking under water, Ruscoe's new Alum O Bond is a synthetic-rubber (Buna N) type originally formulated to repair swimming pools without draining. It bonds to any surface, submerged or otherwise, and sets with the stretch of a rubber band.

Loose fastenings that are too corroded to remove or redrive can be resin-tightened several ways. If the wood around them has softened from leakage, give it the same treatment as for rot. Where there's excessive space around bolts, as in deadwood, flow in any of the boat glues. If the glue seeps out between wood sections, let it set. It will seal the leak. Then flow in a final dose to complete the job. If you want to allow at least a slim chance of removing the bolt later, use resorcinol. It bonds to wood, not metal.

Breaks, splits, and gouges are simple on-the-spot repairs with gap-filling boat glues that need little or no pressure. These include resorcinol, epoxy, polyester, and an acrylic. The one developed by the University of Pennsylvania professor of dentistry is trade-named "3-Ton Adhesive." It holds as well in a wide glue line as a thin one. At 70 degrees, it sets in five minutes, and can be set in three on small jobs by using a high-speed activator.

A leakproof hide is the final touch for the old hull after you've taken care of her major ailments. These are not paints, but brush-on skins of synthetic rubber such as Callahan's Seaprene (made from chloroprene) or plastic such as Kenyon's Vinylon. To provide a nonskid surface with a new coating, Kenyon offers flexible Vinyl Weve mesh at 15 cents a square foot. It's laid in a tacky coat of Vinylon, and given a

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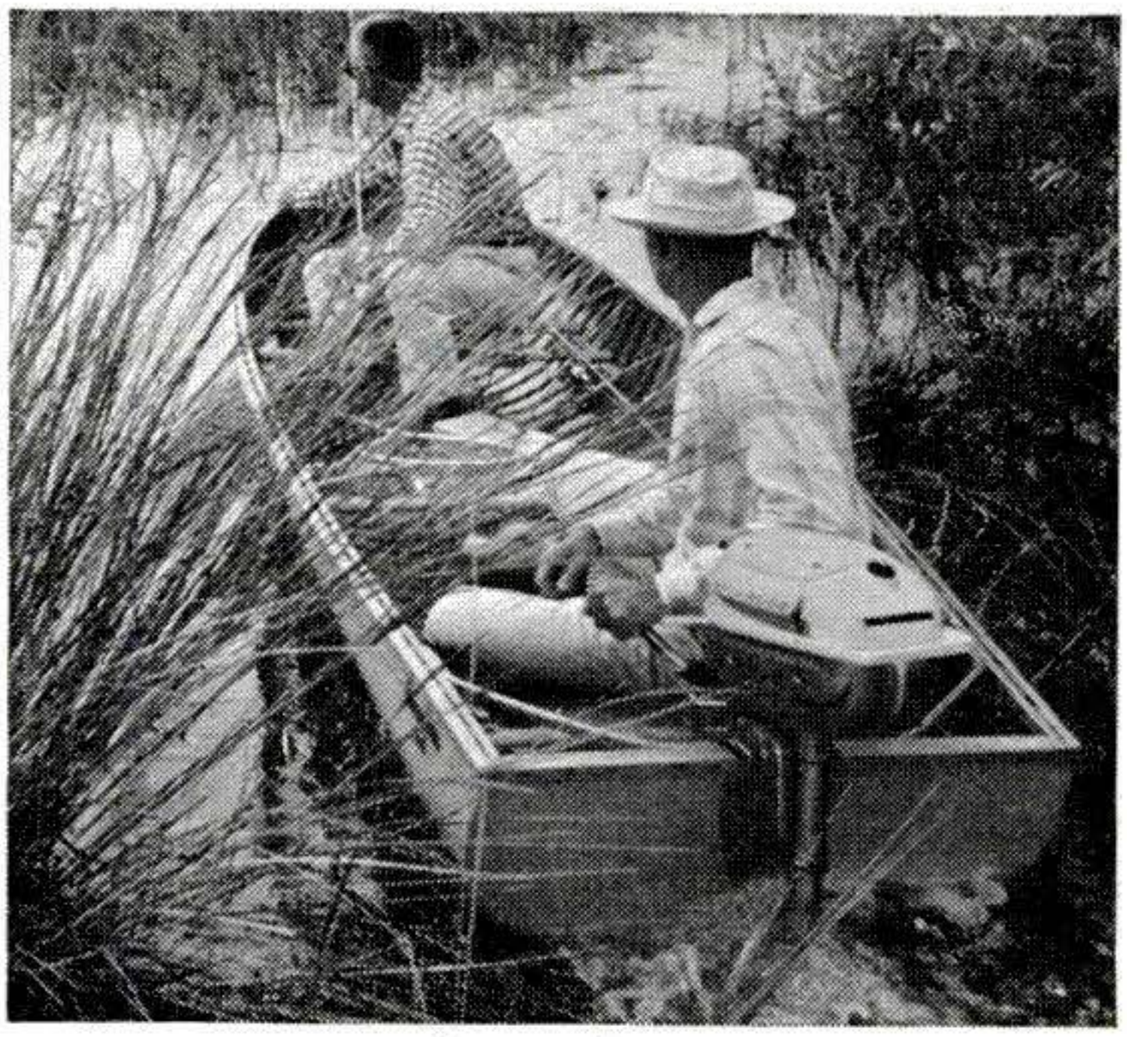

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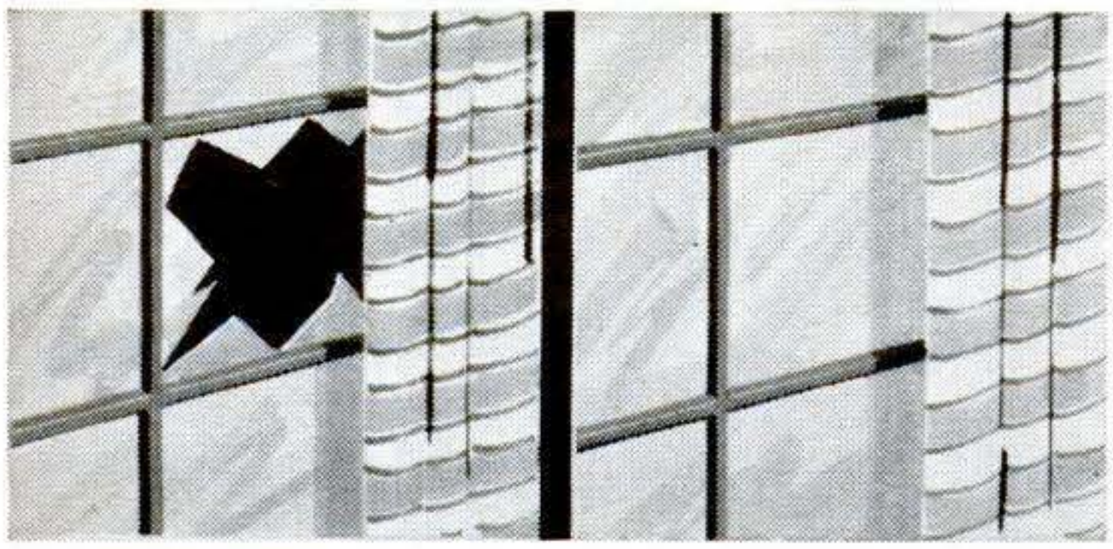

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Most of them can be applied over existing sound paint and can have paint applied over them. Manufacturers generally recommend a single refresher skin coat every two years. The long-term weight increase of added coats is negligible compared with the water absorption they prevent. Prices range from $15 a gallon for a regular chloroprene-type coating to $36 for an antifouling bottom skin. Coverage runs about 50 square feet per quart in one coat.

For centerboard leaks. If the boat has been afloat, remove the pivot pin and the board (with the hull upside down) and mop out the trunk with rags tied to a batten to speed drying. When the trunk is dry, apply the coating to the inside with well-saturated felt on the batten. You are concerned mainly with the inside surfaces up to a little above the waterline, so the task isn't as tough as it might seem. Apply at least three coats with the prescribed drying time between them.

Usually, no wide seams are involved inside the trunk. But if there are any they should be calked first by inserting an ample blob of calking compound with the boat propped on its side. The calking can be roughly worked with a batten. Smooth it as well as possible, let it dry, and apply the coating skin.

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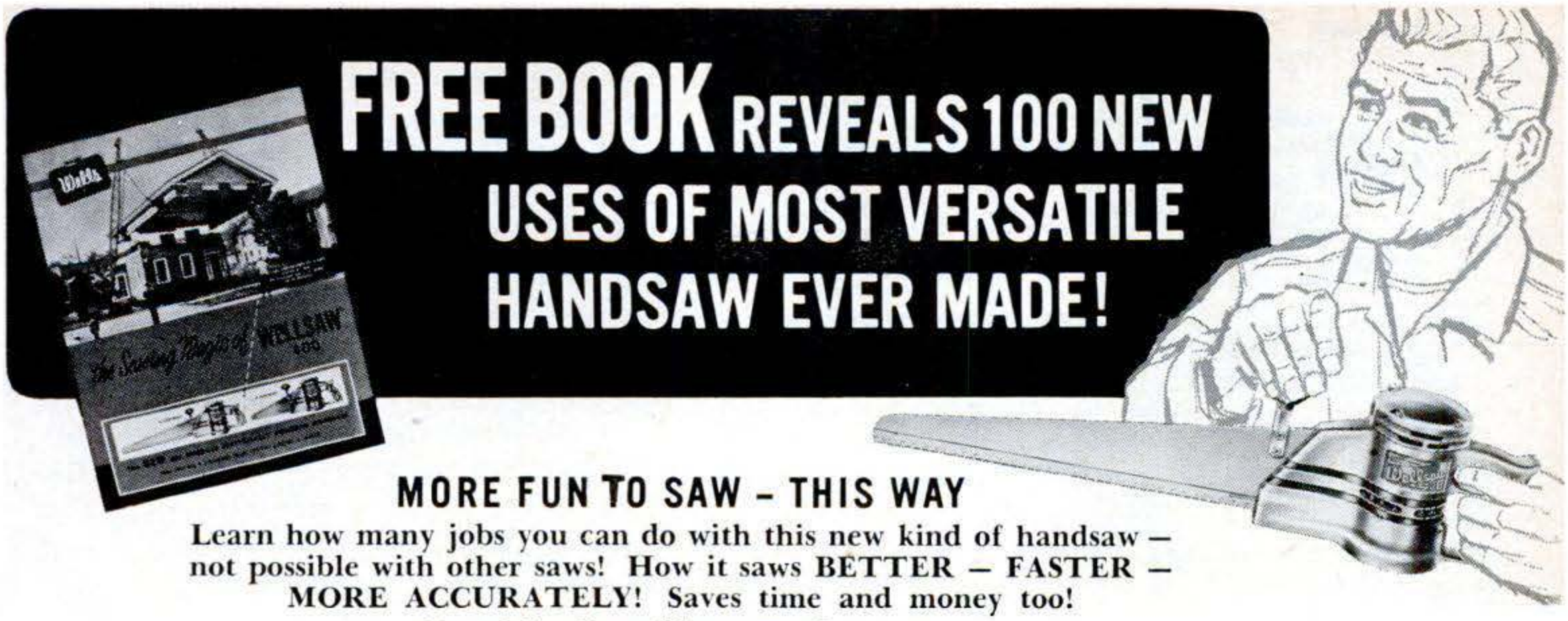

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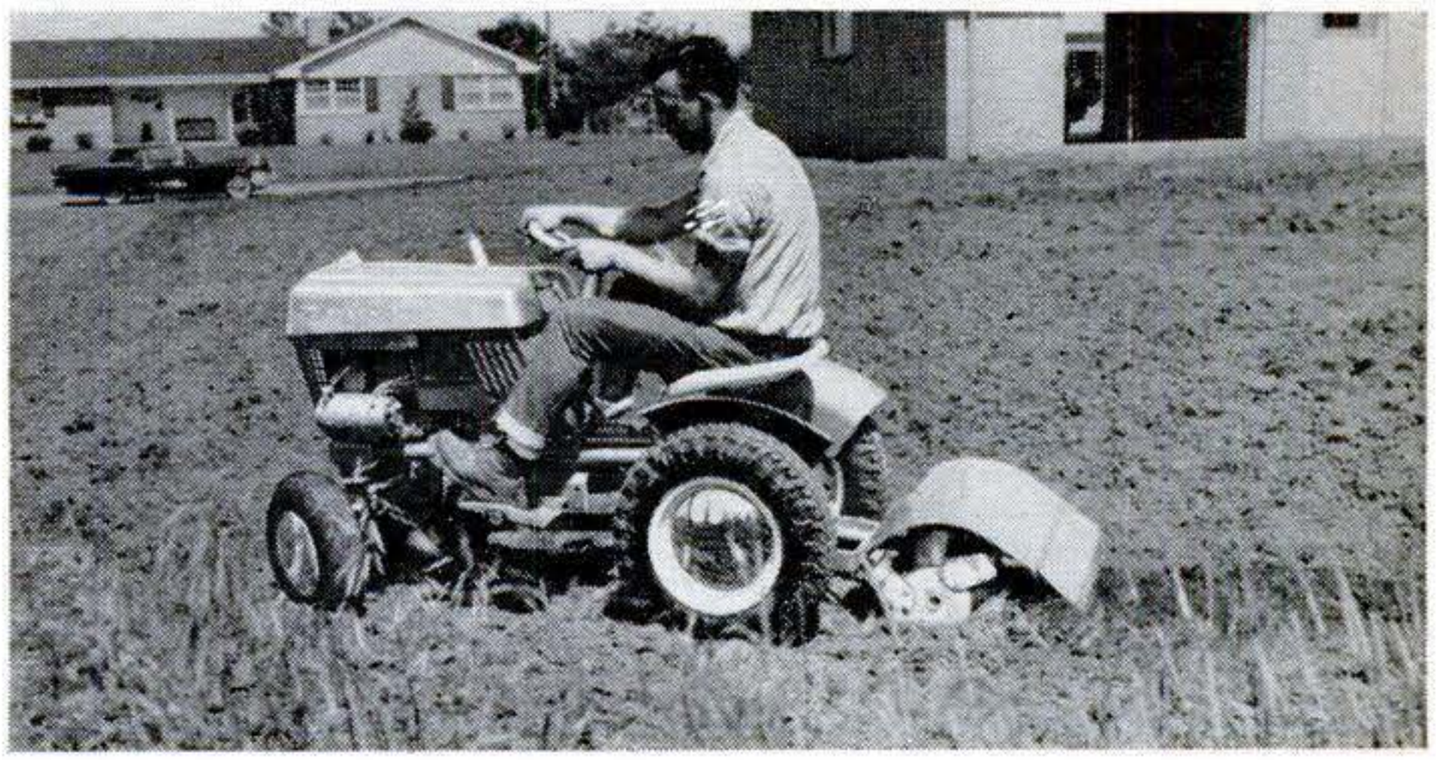

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The Coast Guard's Worst Week

[Continued from page 83]

general alarm sounded, the captain watched the rushing sea surge into the gaping hole behind him. Then, miraculously, the rush of water ceased. The bulkheads had held, and Heinmaa knew that the Gem was not going to sink just then.

"Fire the flares," he ordered.

Nine lonely hours later, the flares were sighted by the Jytte Skou and, for a few happy moments, the men on the bow thought that rescue was at hand. But the Dane couldn't move in for a rescue. The men aboard the Gem could only wait for the storm to abate. By 10:00 a.m., Thursday, waiting time was about over. The bow was on the verge of sinking.

THEN, over the horizon, quietly and competently cutting through the scud of the sea, came the 20,000-ton passenger ship Victoria of the Incres Lines. Her crew: primarily Italian. Her passengers: 445 vacationers, mostly Americans, returning from a Caribbean cruise.

Capt. Roberto Mantero had gone to his cabin briefly when the telephone rang. The radioman had intercepted traffic between the Jytte Skou and the Coast Guard about the plight of the Gem. Mantero was back on the bridge fast, checking the position of the wrecked tanker against that of his vessel. They were only 12 miles apart!

Seconds later, his helmsman had a new course.

When the Victoria arrived on the scene, the passengers and a good portion of her 300-man crew stared, awed and dismayed, at the jagged hunk of metal that was once a ship.

Slowly Captain Mantero maneuvered the Victoria to within 1,000 feet of the Gem. Then, from both sides of the liner's clean hull, black diesel oil flowed into the sea. Two tons of it poured out before the waves calmed enough for Mantero to order the pumps stopped.

The job was now in the hands of Second Officer Paola Carcavallo and a picked crew of 12.

Somehow a motor-lifeboat was launched. Somehow it escaped being crushed against the hull. On the bridge, 50 feet above the sea, Captain Mantero watched the lifeboat disappear from view in giant troughs.

The eight men aboard the Gem also watched. Rescue was at hand, and Second

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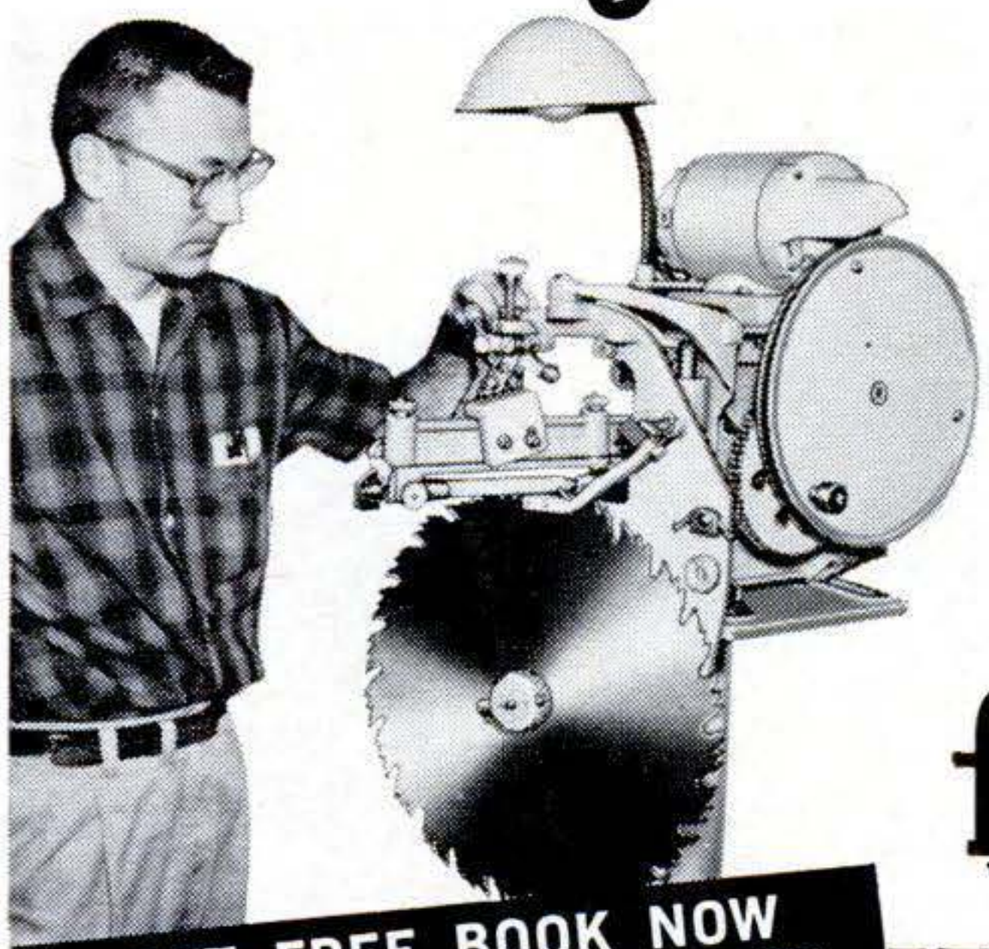

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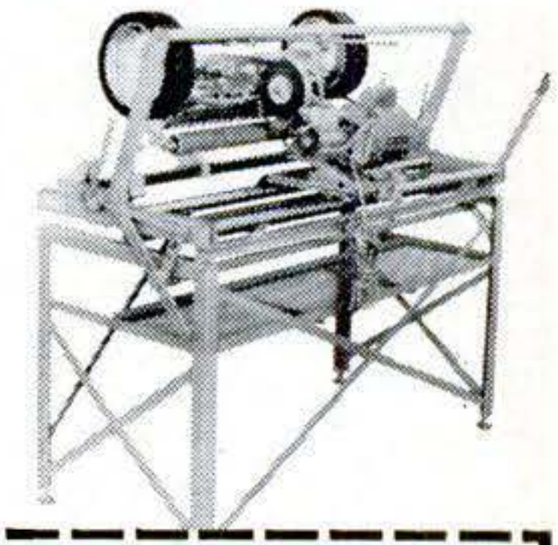

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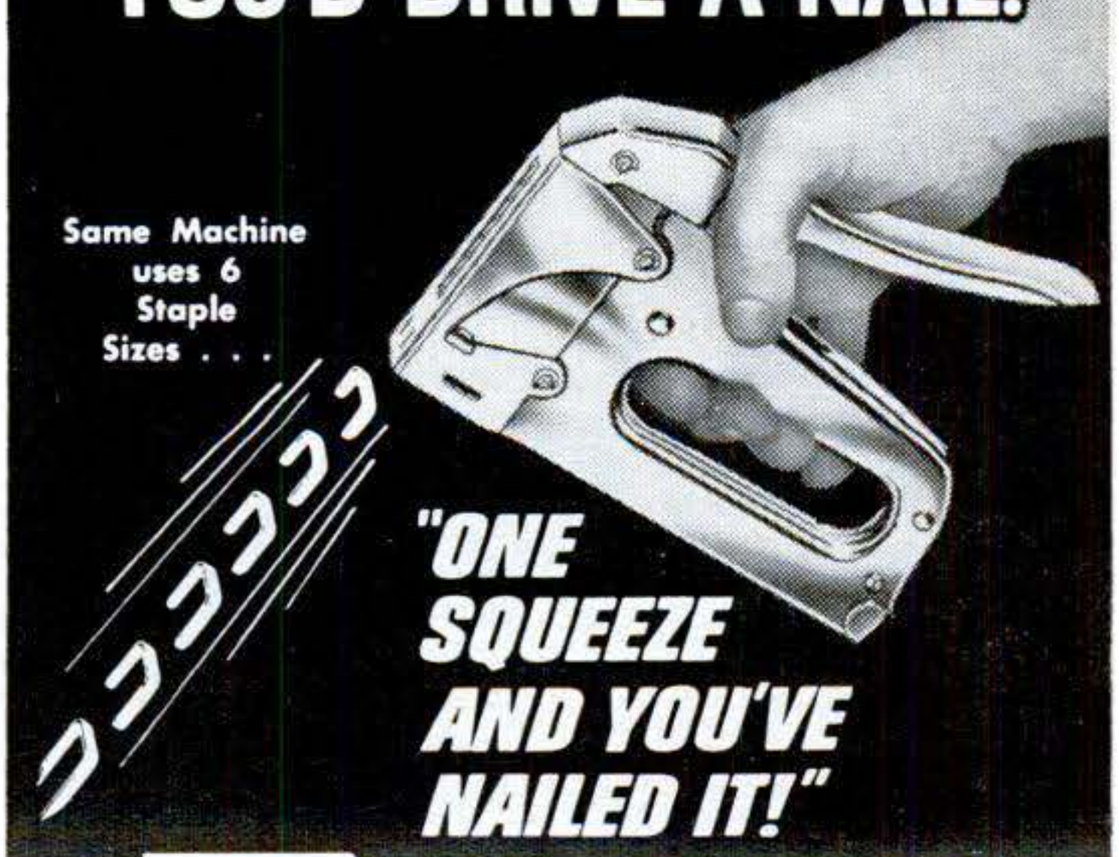

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Officer Bamberg set about launching one of the tanker's lifeboats, so that the transfer to the motor launch could be made without delay.

One minute Bamberg was seen working on the davits. The next minute he disappeared from sight. By some miscalculation or accident, Bamberg had slipped between lifeboat and hull and been crushed to death.

WHEN the Victoria's lifeboat finally reached the Gem, they saw his lifeless body in the water, floating face downward, his clothing snagged on jagged metal where the vessel had snapped apart. As they looked, held off by the running sea, a particularly strong swell swirled up; Bamberg was gone.

The rescue crew turned their attention to the seven men remaining on the Gem. The survivors could not lower the Gem's lifeboats. Rope ladders were out, too, since the launch couldn't approach close enough to the hull. There was only one way—the seven would have to jump for it.

Three times the lifeboat circled the wreck. One by one, the men jumped into the sea, grabbing lines thrown to them, and were hauled aboard. Last to jump was the Gem's skipper.

Then came the return trip to the Victoria, and perhaps the most dangerous moment of the rescue. The boatswain inched his small craft as close to the big ship as possible. When both were rolling favorably, he pushed the bobbing launch to the Victoria's side. Davit hooks were engaged, and the boat rose from the water.

On the bridge, the quartermaster made the log entries: "Lifeboat lowered 1145. Lifeboat back aboard 1220. Seven men rescued."

Total time: 35 minutes.

WHILE the rescue was taking place, Commander Randle in his search plane radioed he had found the Gem's stern.

Randle skimmed her masts. The survivors were bunched together near the deckhouse. A sign had been painted in large white letters on the deck: "27 MEN, SOS GEM." In his excitement, whoever wrote the sign had miscounted. There were 26.

Sighting of the Gem's stern gave the RCC controllers hope of getting through the storm without major loss of life. News of the sighting was broadcast to all ships

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at sea; the race to save the 26 men began.

First to reach the stern, the destroyer Stribling—skipper, Cmdr. Jack Bailey—got there at 1:00 p.m. By then, conditions had improved appreciably. The wind had lowered to 35 knots; seas were 15 to 25 feet. Not cruise weather, but bearable.

Bailey brought the destroyer to within 150 feet of the Gem's stern, close enough for Chief Gunner's Mate Charles Pike to get a line to the casualty.

The Gem survivors had only to pull. Slowly the diameter of the line was increased until it could bear the strain of one of the Stribling's 15-man life rafts. Rope ladders were lowered, and eight Gem crew members made the return trip on the raft. The rest came across in two more trips, in one of the Gem's own boats.

Before bunking down, Willeh Armans, the Gem's first pumpman, called the night on the floating coffin "the longest night of my life."

BY 5:00 p.m., Thursday—33 hours after the Dumont was first heard from—her situation had been brought under control. She had finally been found by a Coast Guard plane, 90 miles from her reported position. She was making excellent progress. The Chun Lee had been reached by the SS Whakatane and the cruiser Northampton. The lightship Chesapeake was reporting some progress in moderating seas. The Cherokee's giant screw was still turning.

From then on until the storm blew itself out, it was strictly a mop-up operation. The Dumont made it past the Delaware Breakwater. The Chun Lee anchored in Hampton Roads. The Chesapeake limped into Old Dominion Shipyard, Va. The Victoria landed seven survivors in New York; the Stribling, 26 more in Mayport, Fla. The Cherokee reached quiet water for repairs, then went back on patrol.

Four large ships, the lives of 106 seamen, had been in danger. Three of the ships and 105 men had come through. According to probability tables, the death toll should have been worse. How had a greater tragedy been averted?

"All the cases were potential disasters," Controller Wescott conceded. "But the crews took effective action. The response of merchant and naval ships was excellent.

"Then there was the sea," he continued. "You never can tell about the sea." ■■

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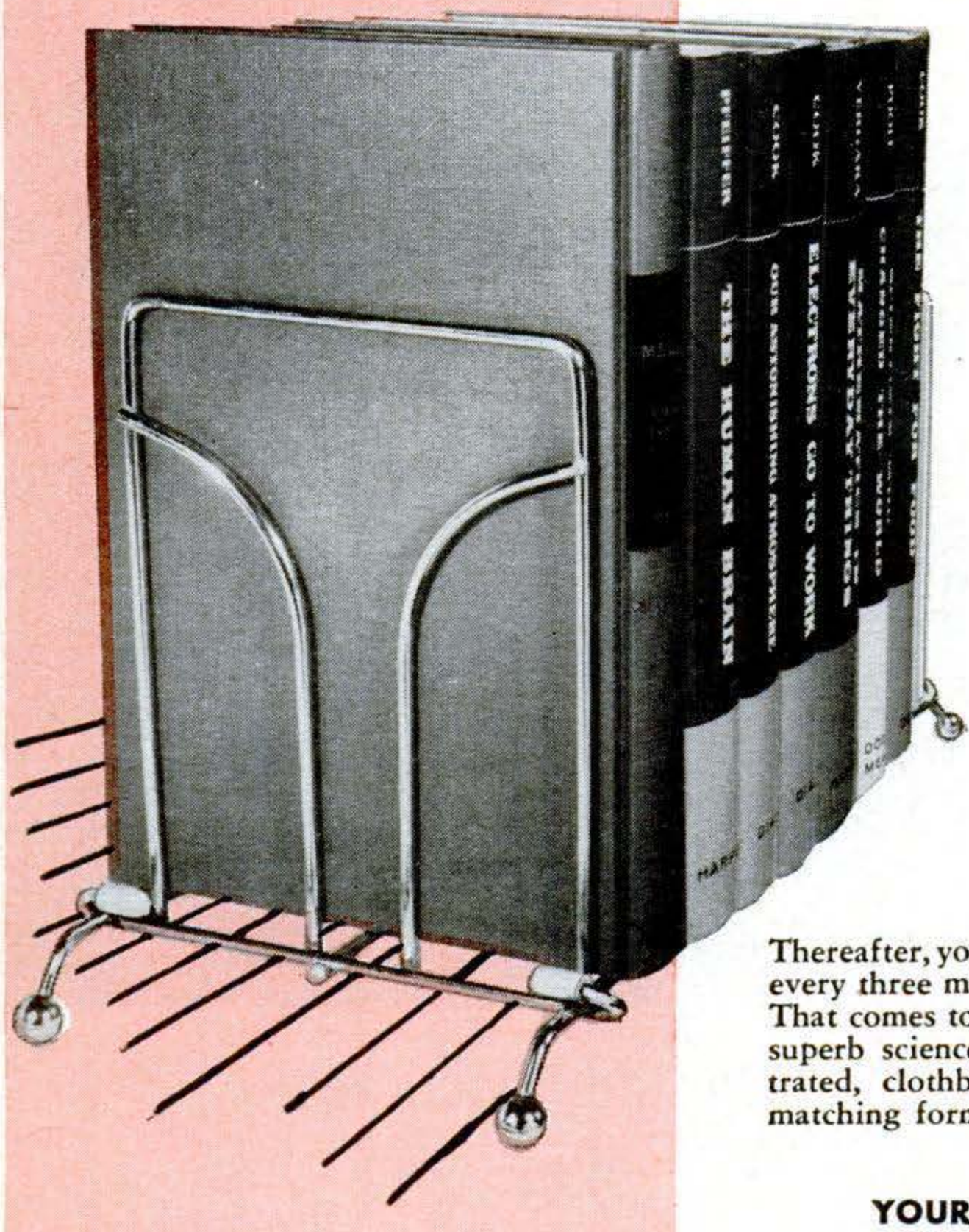

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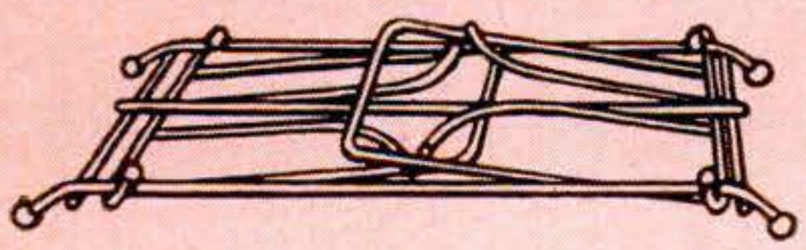

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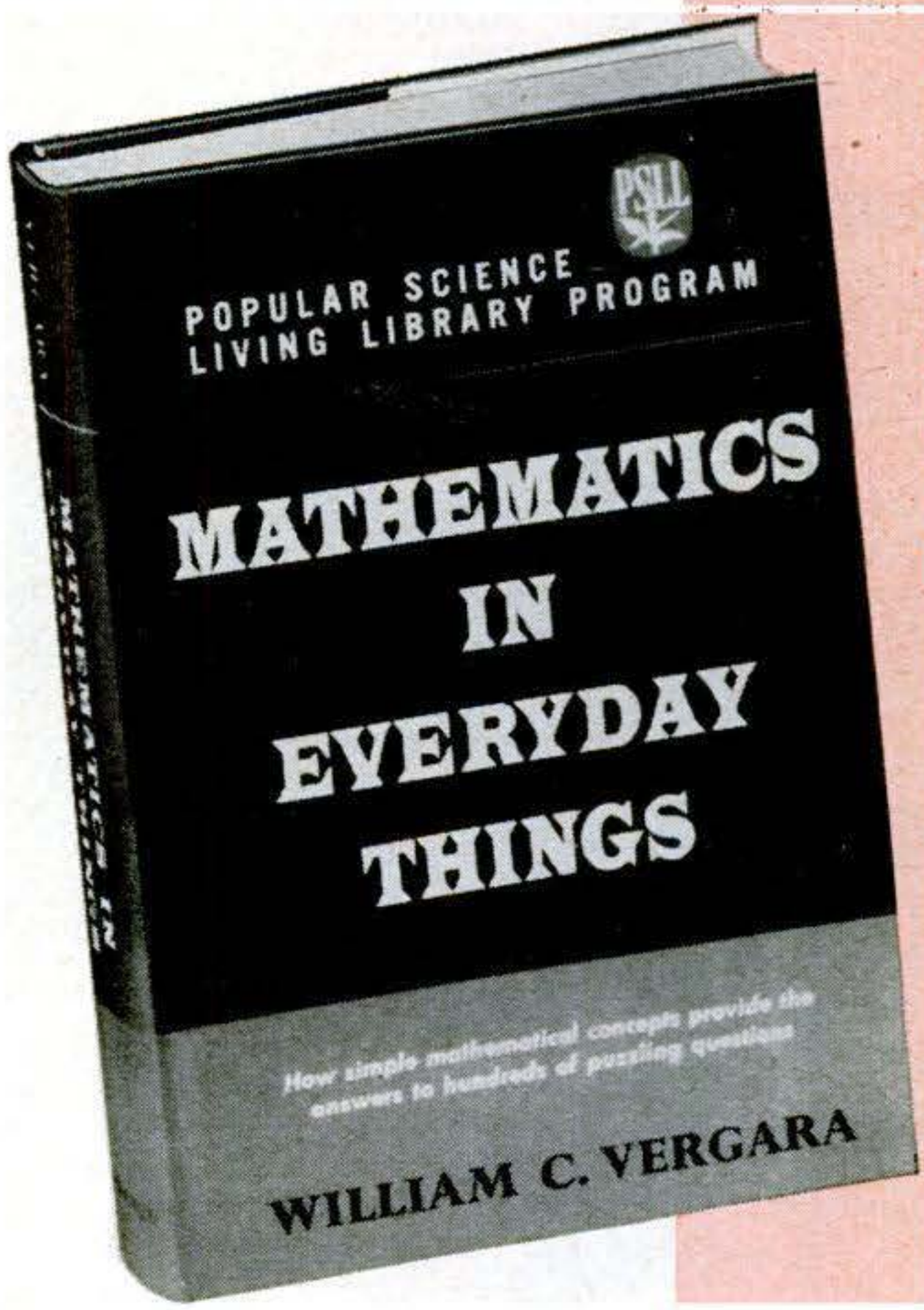

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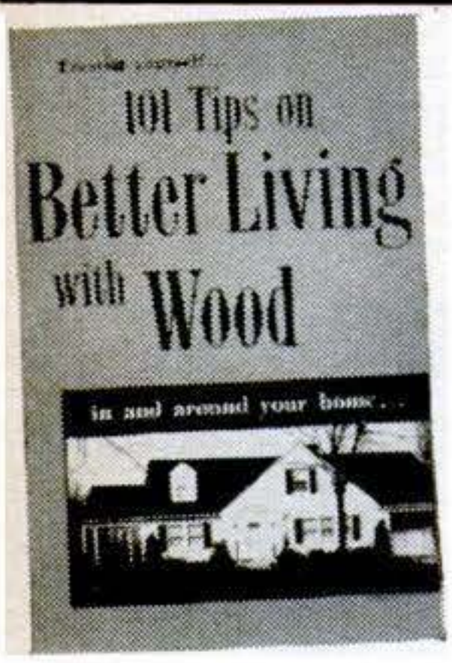

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A Beginner's Questions About Boating

[Continued from page 133]

but want to learn. Are there some books I can read?

A. Yes. Any bookstore has several feet of them. One standard work is Chapman's *Piloting, Seamanship and Small Boat Handling.* It weighs a couple of pounds and should be studied a bit at a time. There are lots of other good books. Your best bet will be to take a look at them and select one that aims at the type of boating *you're* aiming at.

Q. Are there courses I can take to learn boating?

A. You bet. The Outboard Boating Club has a fine course on seamanship. And the Power Squadrons give courses on navigation and boat handling. Most of these are free. Ask your boat dealer about them.

Q. Can I buy a boat on time, like a car?

A. Yes, indeed. Banks like this business.

Q. Is a boat trailer hard to handle?

A. No. But be sure to observe speed laws. Most states restrict cars with trailers to truck speeds.

Q. I've heard the launching places are crowded. Can I find a place to use my new boat?

A. Of course you can. Sure there are lots of boats in the U.S., and some of the launching places are popular and well used on sunny summer weekends. But don't let the scare stories keep you shorebound. We've trailed our boat into some of the most popular launching spots in the country, right in the middle of the nicest weekends. We've never had to do much waiting to launch or to recover.

Q. How good a weatherman must I be to operate a small boat safely?

A. Good enough to turn on the switch of a long-wave radio and to listen to the Federal Aviation Agency's clear and concise picture of the weather outlook in your area.

Q. Should I consider building my own boat?

A. Sure, if you're good at this sort of thing. There are many plans and kits available.

Q. Is it difficult to learn the nautical rules of the road?

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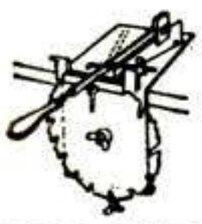

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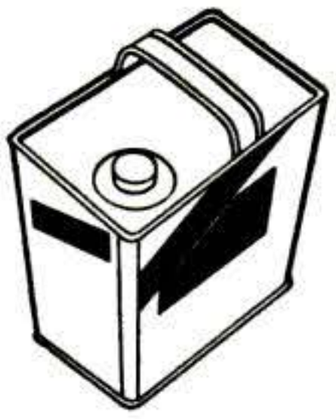

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A Beginner's Questions About Boating

A. No. There are only a few that you'll regularly be called upon to use. Common sense and courtesy are the main things you need to be a good boat driver.

Q. How about insurance?

A. Check this with your own agent, but in general it goes like this: Your car insurance will likely cover your trailed boat, if you inform your agent you'll be trailing it. Then you'll want loss and damage insurance on the boat and its contents. This is available at moderate cost. Make sure, too, that you have liability insurance in case you injure someone or damage property. Your present liability insurance may cover this.

Q. Will I have to buy a lot of equipment?

A. No, you won't *have* to. But you probably will assemble a good bit, year by year. Certain equipment is legally required—life jackets, fire extinguisher, and the like.

Q. What's the best place to moor a boat—at a dock or on a buoy?

A. There is no "best" place. The answer will depend on your boat, the harbor, and your own likes or dislikes. In the same harbor, the rental of a mooring buoy is usually considerably cheaper than the rental of a slip. But you then need either a dinghy or the use of a taxi-boat to get to and from your boat. This adds a little to the cost of mooring. Another advantage of buoy mooring is that your boat will swing her nose into the wind automatically, and thus ride any rough harbor swells to the best advantage. Personally, though, I like a slip. It's easier to load gear and supplies, and you can go aboard without inconvenience.

Q. How about this matter of thievery? Do I dare leave outboard motors and other gear on the boat at its mooring, or should I always take them home?

A. My answer to this is: Insure 'em and leave 'em on the boat. You'll need to temper that with reason, of course. Take all possible precautions to close up your boat, and lock it. If you have something that's really irreplaceable, tuck it under your arm and take it home. The incidence of theft of motors and other gear varies widely with different areas and different harbors. You'll do well to find out the local situation. We moor our outboard cruiser in Burnham Harbor,

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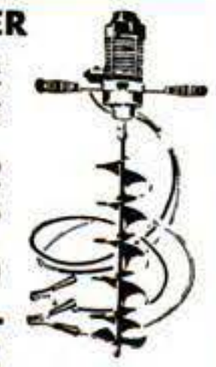

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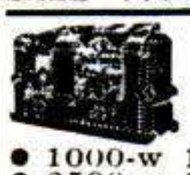

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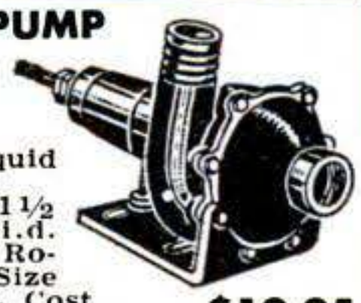

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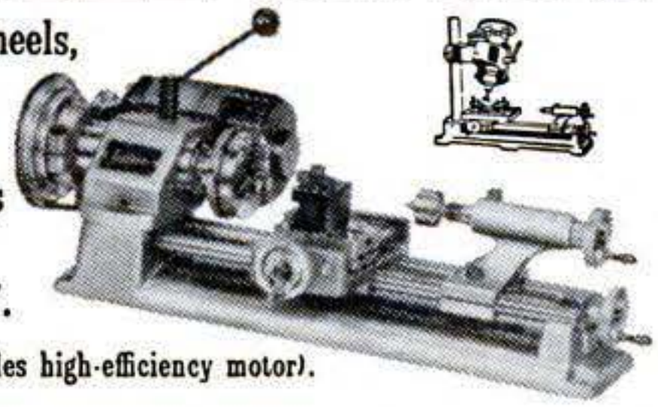

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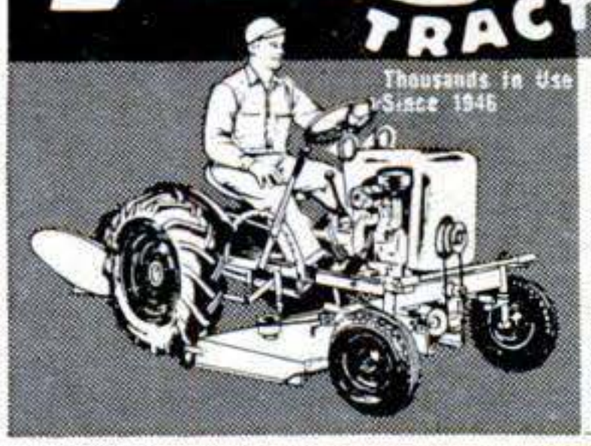

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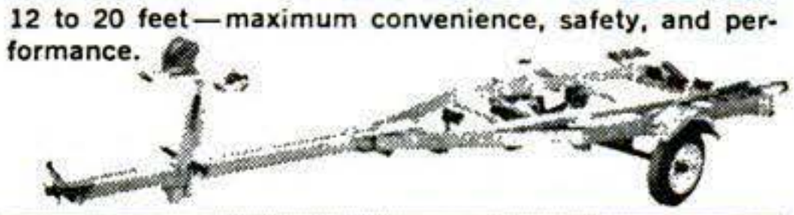

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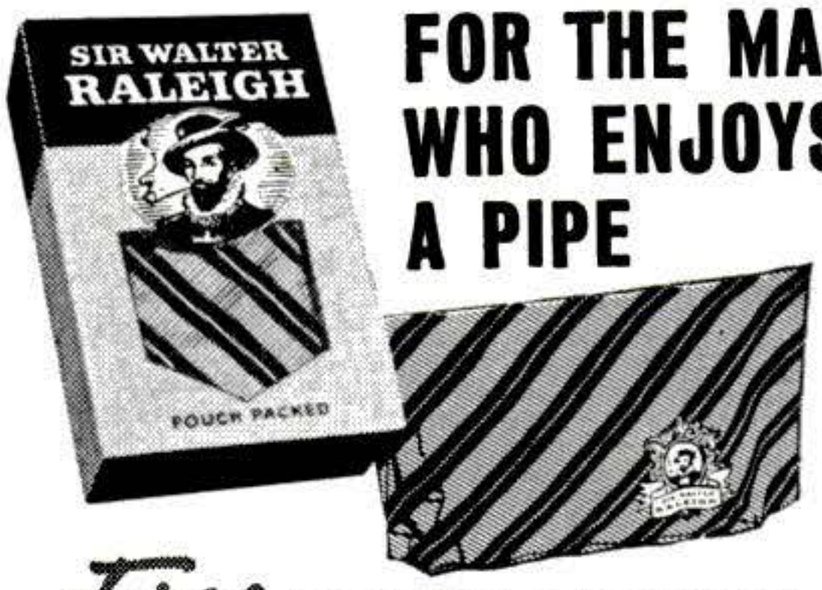

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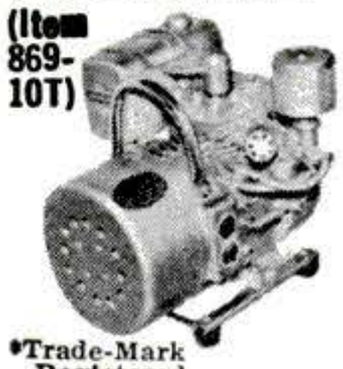

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in the heart of Chicago. To the best of my knowledge there is practically no loss. Most outboard motors these days are so heavy, and have so many connecting controls, that it is unrealistic to take any but the smallest ones home at night.

Q. Shall I start with a big boat or a small one? Some of my friends say it's just as easy to handle a 20-footer as a 14-foot one.

A. I'd say start with a size you can afford, and one you can easily moor or transport. Ease of handling in the water is a matter of degree. Yes, a 20-footer might well handle just as easily or easier than a 14-footer, because it will probably be much more seaworthy due to its increased size. I've trailed a 22-foot outboard cruiser, equipped with twin 75-hp. outboard motors, for thousands of miles with no sweat.

Q. Which is easier to handle—an inboard or an outboard?

A. I'll have to straddle the fence on this. Outboards give you lots of speed for the power. They are easily installed and can be transferred from one boat to another. Perhaps greatest of all, they give you greater freedom of movement—ease of handling on a trailer, the ability to ease close into a shore.

One disadvantage of outboards is that they are not as efficient with fuel as inboards are. Another: Unless the boat manufacturer builds a really waterproof motor well (and many do not), the cut-down transom at the stern makes your boat more vulnerable to a following sea. Outboards give you more positive steering control, plus power-backing, since you can so easily rotate the lower unit. The inboard-outboard drive has many of the advantages of both outboard and inboard.

Q. There's a fancy marina in our town, but it's expensive. There's an older yard that's quite a bit cheaper but doesn't offer as many services. Is the marina apt to be worth the difference?

A. This depends a lot on you. If you have the time to do your own maintenance, the lack of services may not bother you much. But if you want your boat ready to go in response to a phone call, you'll have to go where service is available. Price each marina and go where you get the most things you want for the money you can afford. ■■

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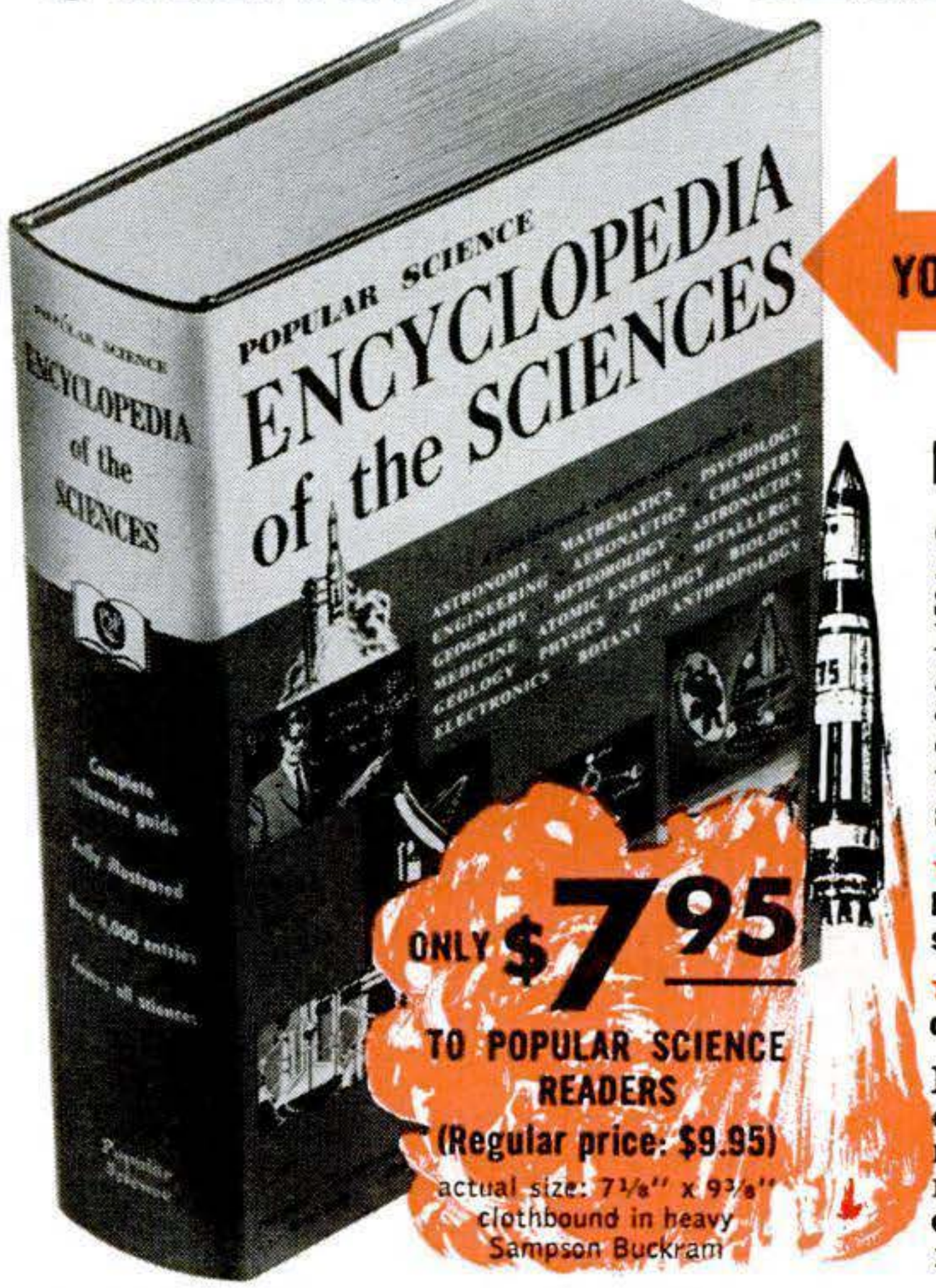

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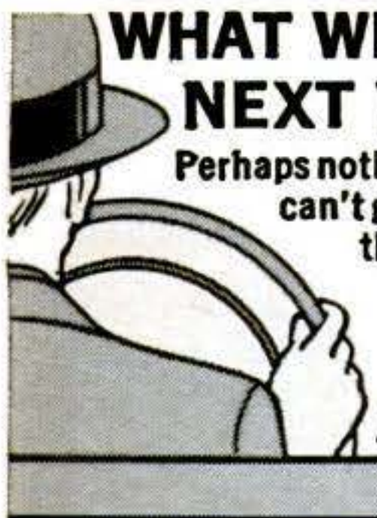

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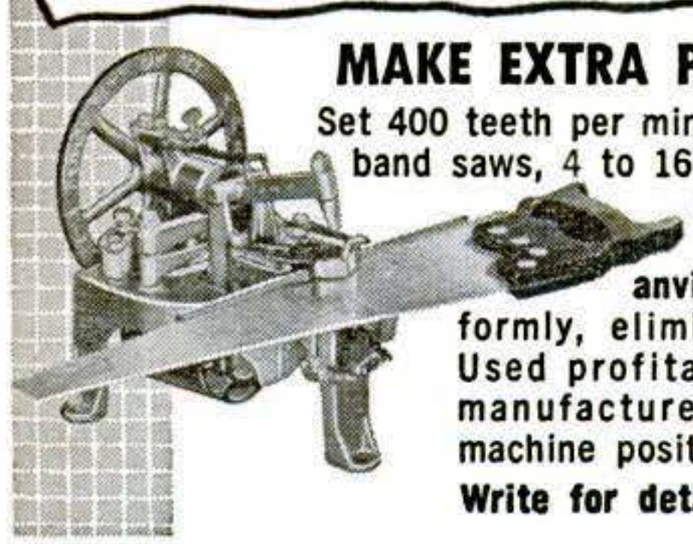

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Buying a Used Boat

[Continued from page 130]

later sell them because of resulting headaches. Alone, either boat or motor may be a bargain—if you can buy them that way.

A little detective work helps judge a motor. If it's accompanied by well-worn water skis, it has probably had a life of high speed and rugged use. If only fishing tackle is in evidence, the reverse is likely. Look at the propeller. If it's in bad shape, with plenty of chips and nicks, it has carried many an impact to other engine parts.

In any event, experts advise a test run of at least five minutes. If an on-water test isn't possible, ask to take the motor to a boat yard that has a test barrel available. If the motor overheats, there's pump or cooling-channel trouble. If it smokes excessively, it may have a heavy oil mix to wring some compression out of worn rings.

After the test, take the plug out of the lower gear housing. You should see plenty of grease. If none shows, only opening the housing will tell you if the gears have been damaged by long-term unlubricated use. (You can't tell much by wiggling the prop, as most motors have considerable play even when new.)

Do you suspect trouble? Then check on the availability of parts. If you can make your own repairs, you may still have a bargain. If not, get a mechanic's advice.

Sailboats. On a used sailboat, sails often are a price factor almost equal to the boat. If they're cotton, they're likely to be close to five years old, as only a few cotton sails have been produced since then. If they've been used every season, they're going.

If the sails are nylon, top sailmakers like Hathaway, Reiser & Raymond advise taking a good look at the seams. Sewn with cotton thread (as many are), they may be coming apart here and there because cotton can rot. If there's a free piece of the thread, test it with a match. Cotton simply burns. Nylon burns and melts. Your best bet on bad seams is a professional resewing job. In Lightning and Star size, this costs around $50 instead of $225 and up for new sails.

Check a sailboat hull like any other, but with close attention to the centerboard trunk if it has one. Leaks are likely at the joints between the trunk and hull. If no rot is present, you can usually achieve a reasonable cure by calking. And, after all, many a new centerboarder has the same trouble.—*George M. Daniels.*

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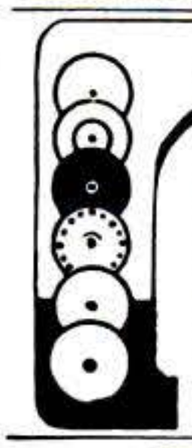

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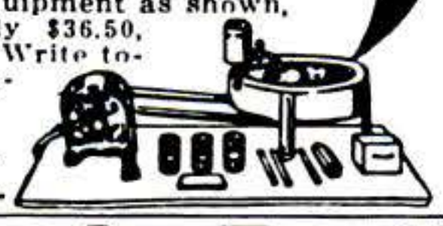

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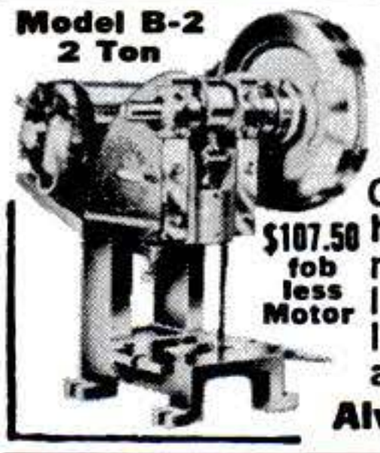

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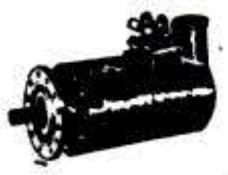

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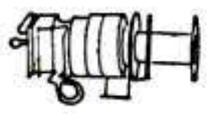

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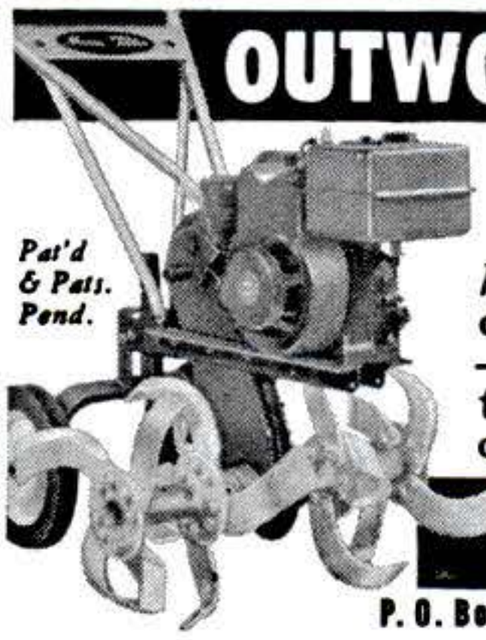

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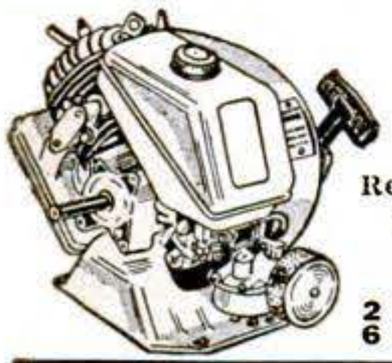

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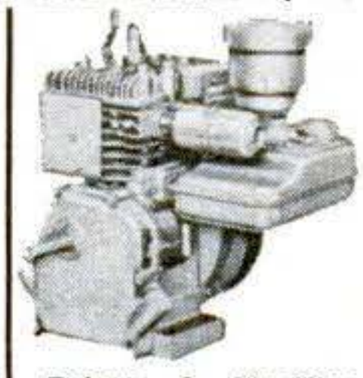

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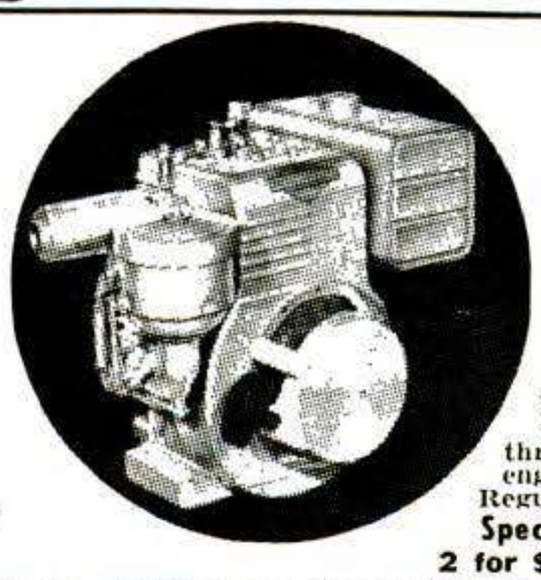

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DYNAMIC WELDER CO. 1808 SOUTH FEDERAL STREET Dept. D3-C. CHICAGO 16, ILL.

[Continued from page 56]

ferential needs attention. They do not take a compression reading. Such jobs are functions of the repair bays.

The Center makes things easy for you. You can leave your car at any Mobil gas station within a six-mile radius of the Center, and have it picked up, analyzed, and delivered for $4.75 plus $1. Leave it anywhere else within that radius, and the charge is $4.75 plus $2. Beyond six miles, it's 20 cents for each extra mile.

Mobil's wholly new concept of car repair is supported by a study that shows that motorists, increasingly, are going to service stations for minor repairs. For 1957 to 1960, in percentages, here's how the chart looks:

	1957	1959	1960
By car owner	9	9	11
By independent garage	36	36	36
By car dealers	23	19	15
By service stations	26	30	33
Other	6	6	5

In a world of imperfection, Mobil's Repair Center is not the perfect answer to a motorist's repair woes. The diagnosticians and mechanics in the repair bays are human and fallible. Soon after the Center opened, Mobil got into a flap. Quality control in the repair bays was slipping. The company had to fly in a crack engineer-mechanic. He straightened things out.

But the Center is far and away an improvement on anything else offered the U. S. motorist today. Another oil company has two experimental pool repair stations in Buffalo, N. Y., and Washington, D. C., to which its gas and oil dealers can refer work, but there any comparison ends. This second oil company lacks the diagnostic machinery. It does not run clinics.

It is too much to expect that the Gus Wilsons of auto repair—the time honored expert mechanics—are going to cotton to the car clinic. They will have a bilious eye for all those fancy dials.

But of the Mobil operation, one envious service manager employed by a leading automobile manufacturer remarked:

"What auto agency or independent garage could afford facilities like this? Mobil can write off their diagnostic expense to promotion and advertising, and still come out ahead on gas and oil sales. The repair bays will pay their own way. In the next 10 years the idea will spread like wildfire. This is a look into the future." ■ ■

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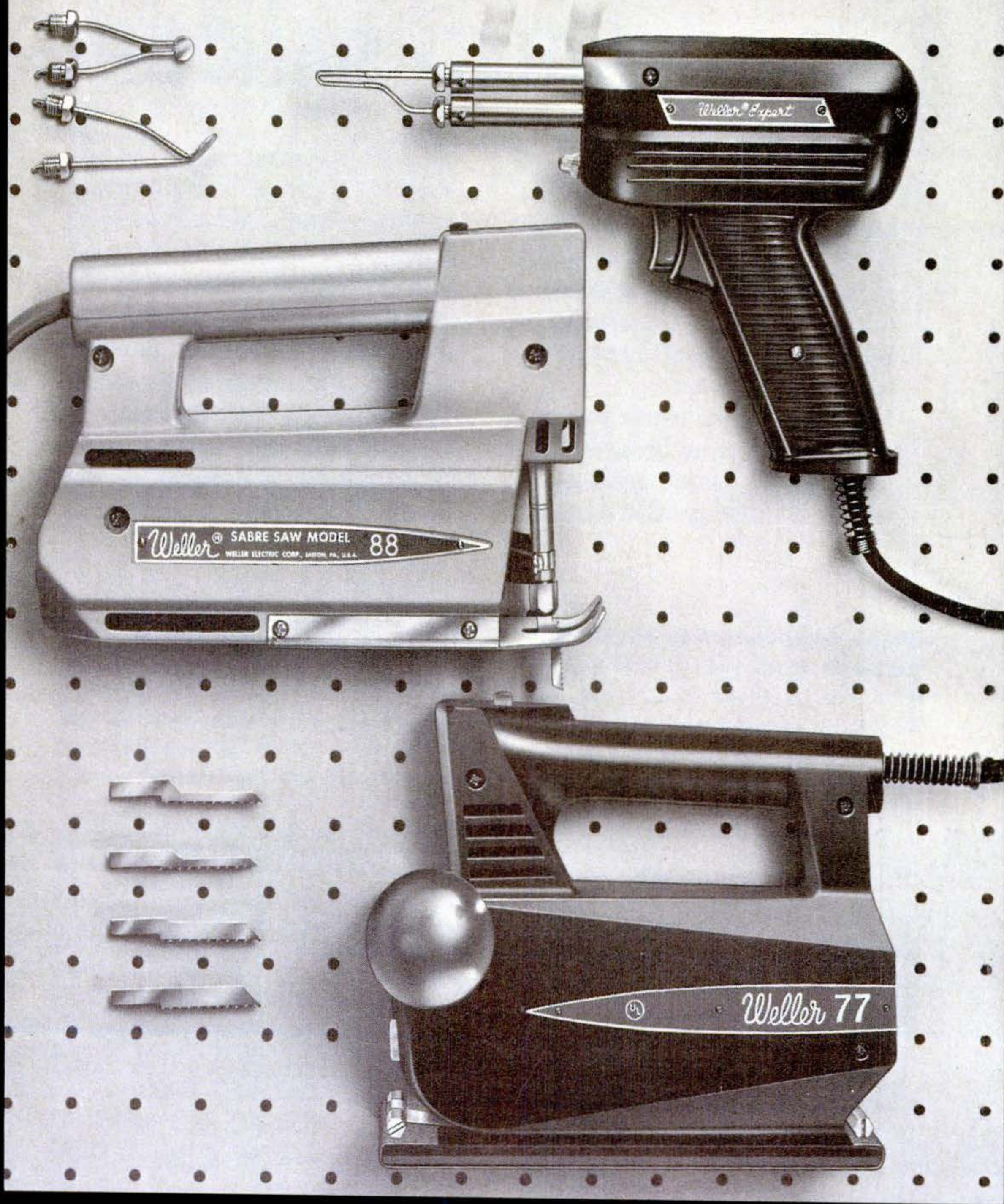

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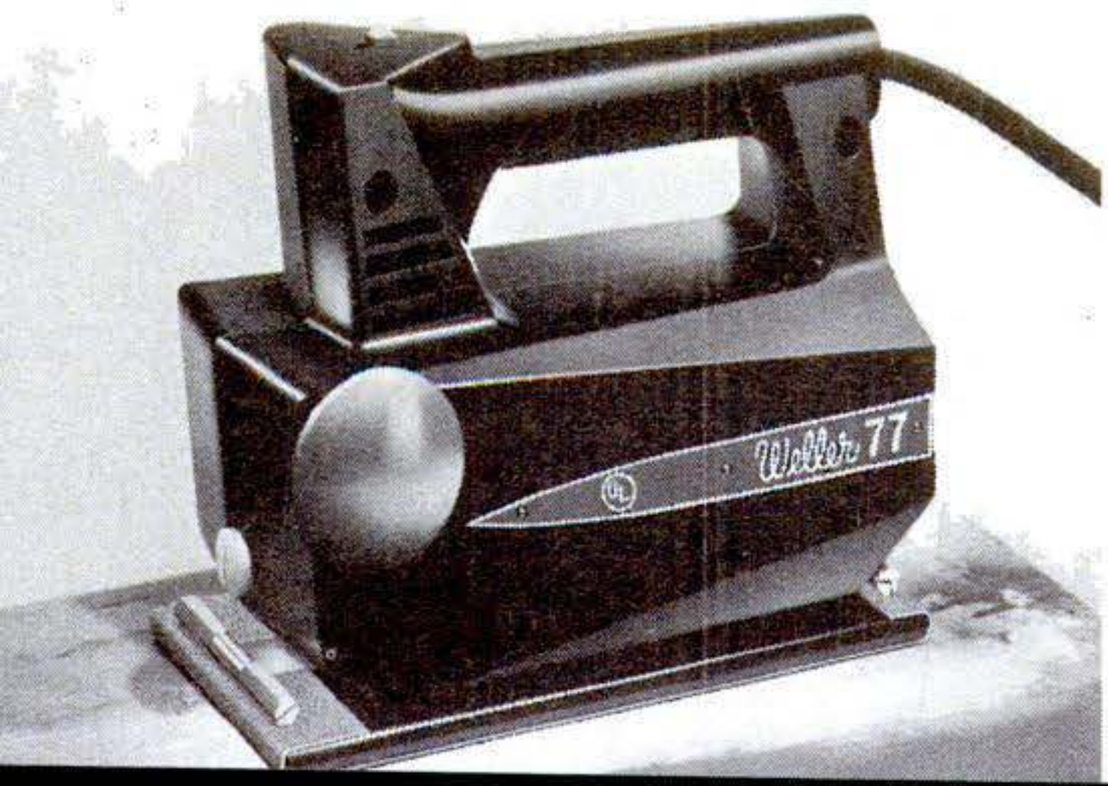

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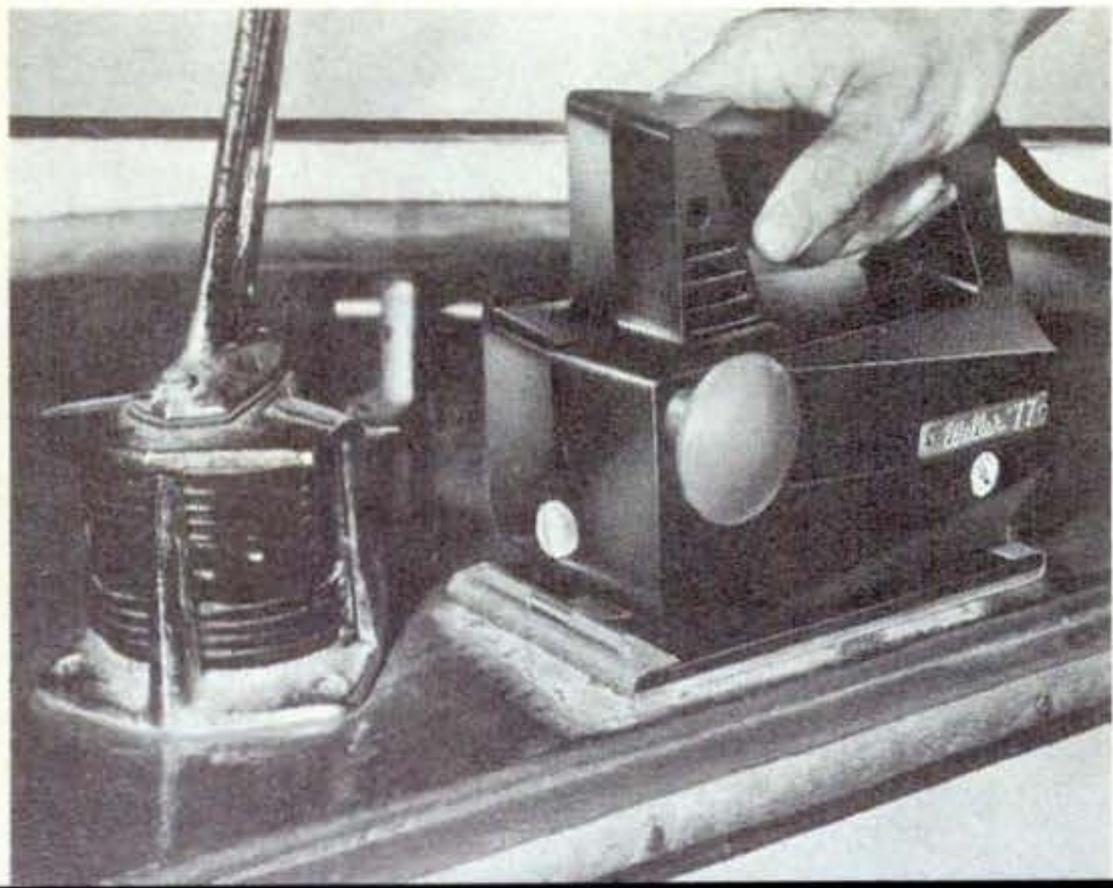

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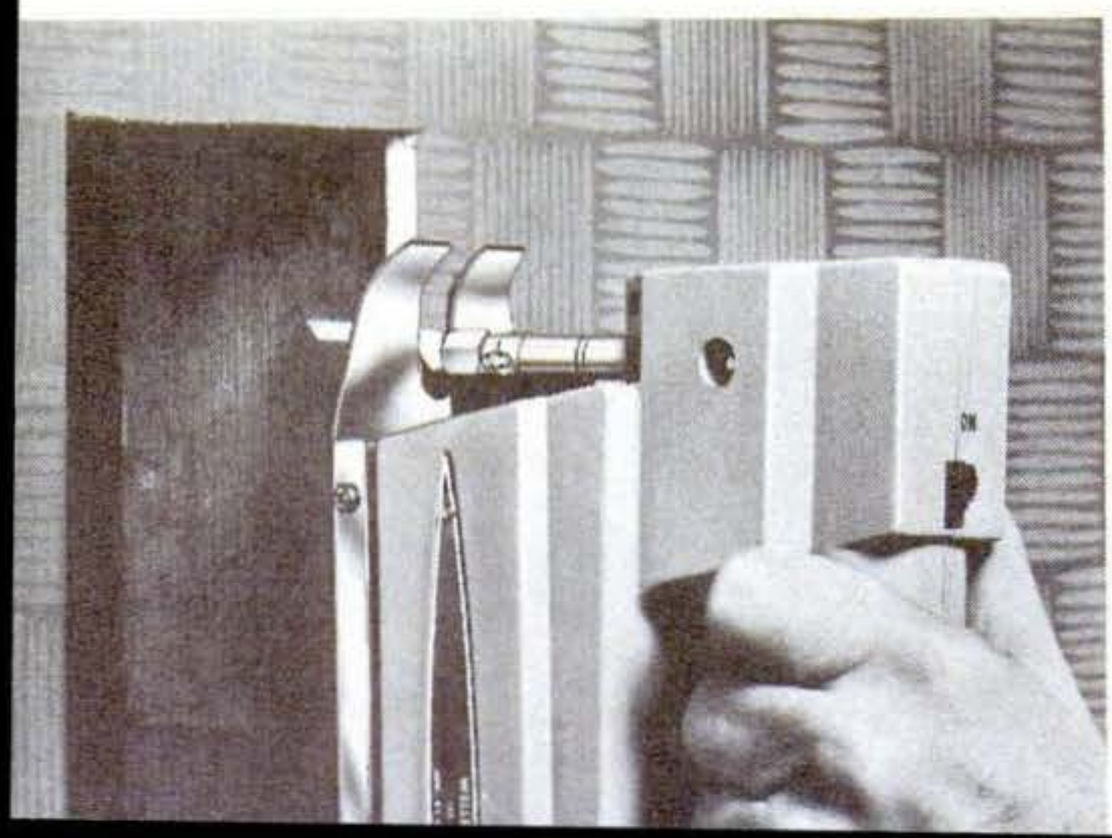

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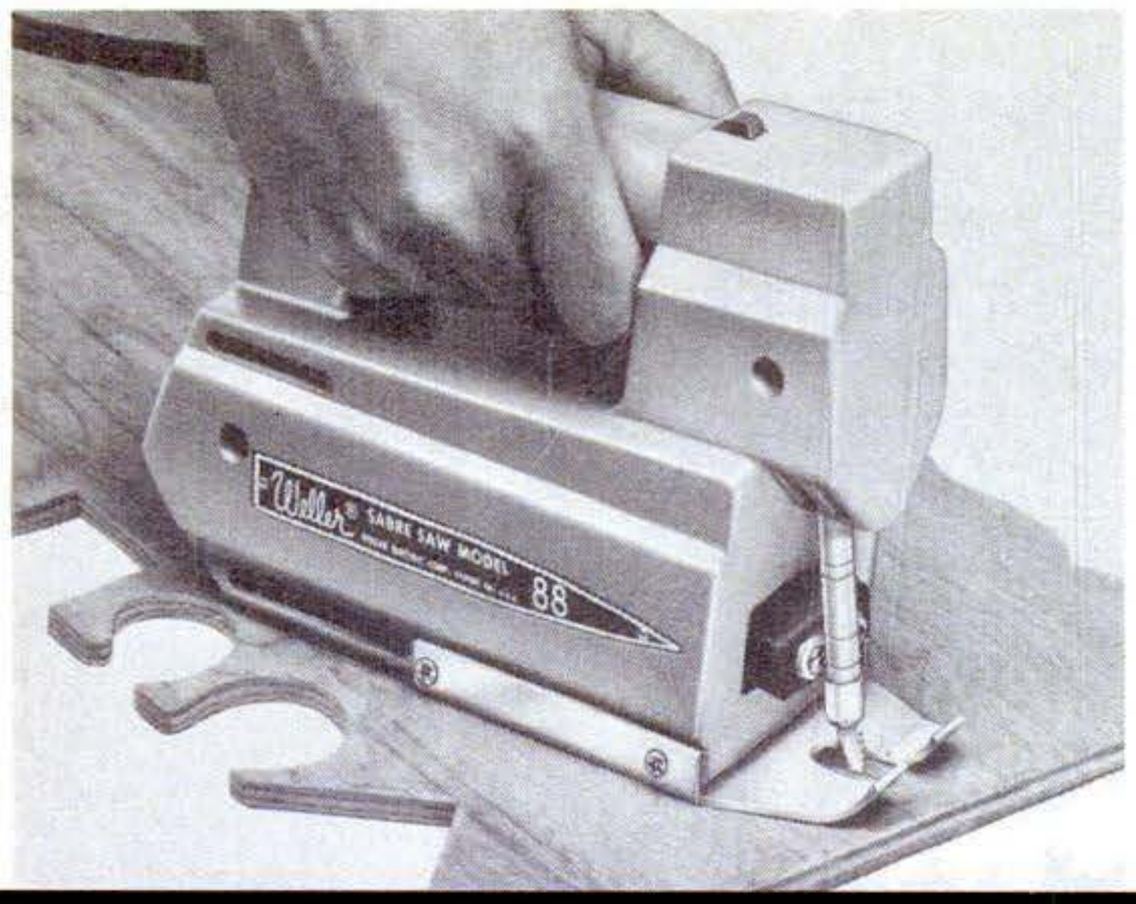

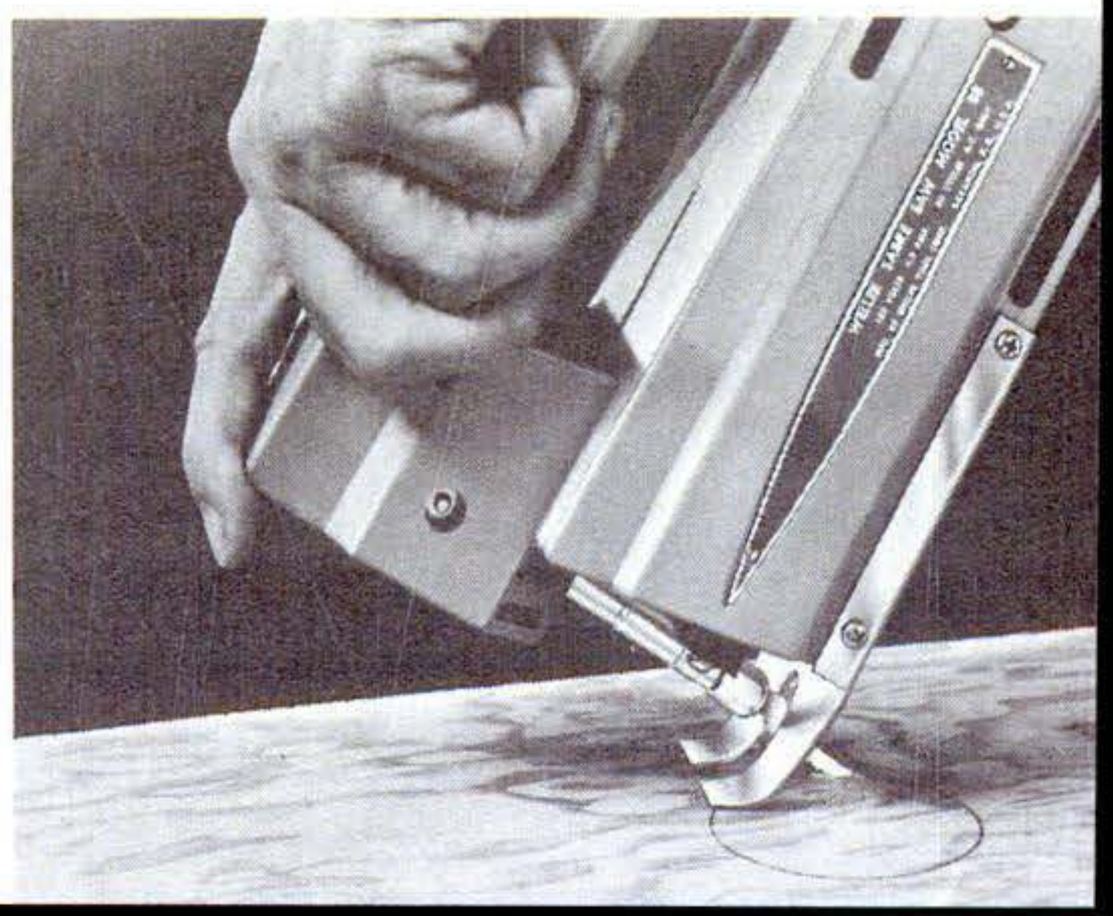

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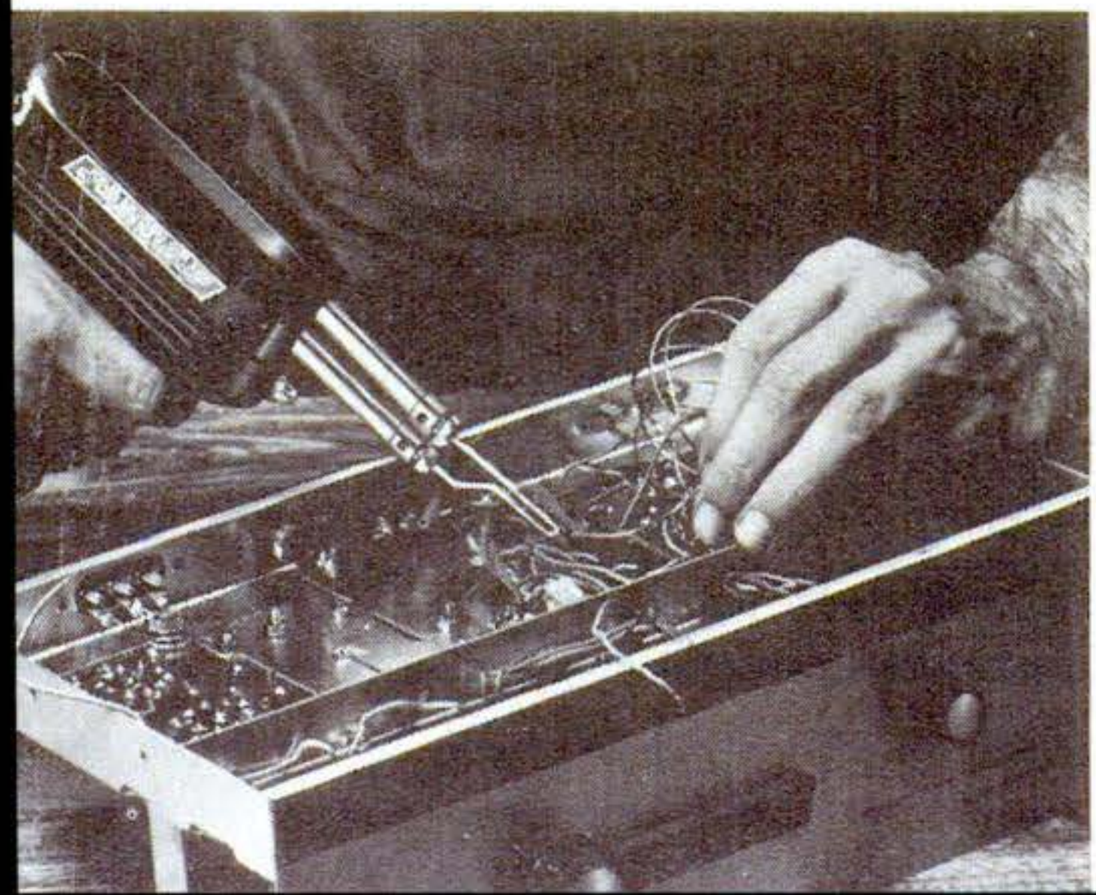
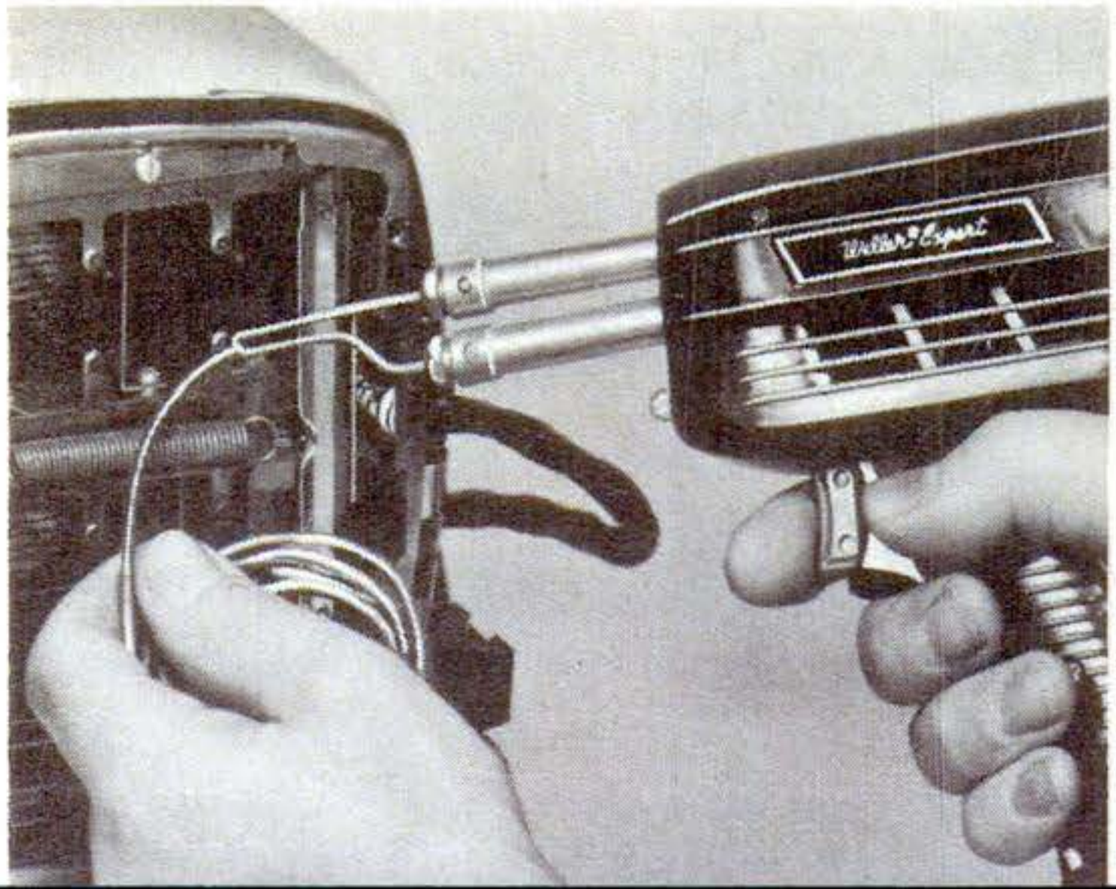
A must for hi-fi kit building, where strong noise-free connections are so important. Instant heat saves time. Dual Heat enables you to use low heat to protect sensitive components, and high heat for the chassis connections.

A money-saver on electrical repairs. A Weller Gun enables you to do many appliance and electrical repair jobs yourself. It's also useful in model railroading, jewelry making, wirecraft, science fair projects, and many other hobbies and crafts.





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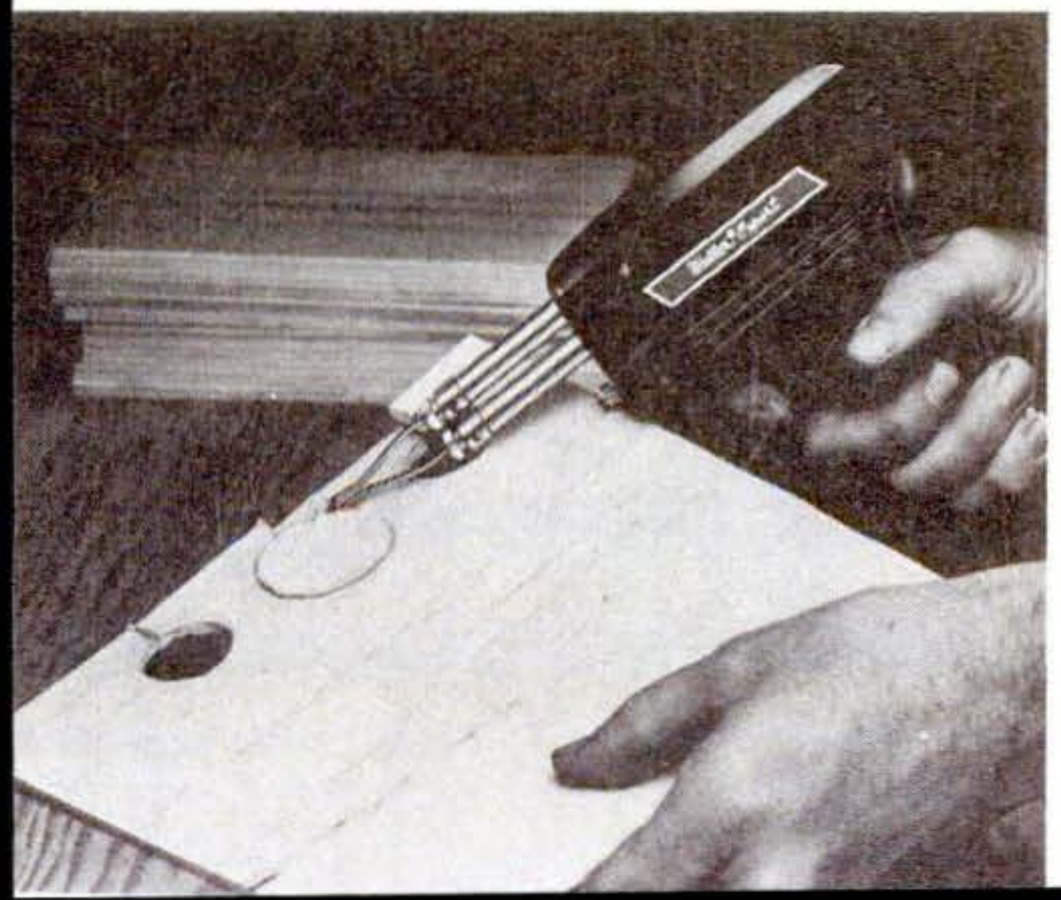
Does many jobs besides soldering. With cutting and smoothing tips you can seal, form, trim or cut thermoplastics; repair plastic toys and utensils; cut and shape plastic tile, seal plastic bags and enclosures, repair furniture dents or scratches.

Mends metal and joins metal parts. Whether patching holes, sealing seams or joining metal parts, your Weller Gun will pay for itself in scores of household repairs. Your dealer will recommend the correct solder and flux for the job.



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Weller®

Heavy Duty Dual Heat Soldering Gun Kit

Features a professional dual heat gun. Two trigger positions permit instant switching to low 240-watt or high 325-watt heat. Tip heats instantly. Spotlight. Kit includes plastic carrying case, soldering tip, cutting tip, smoothing tip, tip-changing wrench, solder. Model D-550PK.

Weller Expert Soldering Gun Kit

Dual heat 100/140-watt gun in plastic utility case. Kit includes 3 long-life soldering tips, tip-changing wrench, flux brush, soldering aid and solder. Model 8200PK.

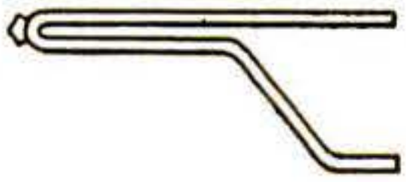
Weller Dual Heat Soldering Gun

Two trigger positions provide low 100-watt and high 140-watt heat. Tip heats instantly and spotlight comes on when trigger is pulled. Premium-plated copper tip. Model 8200.

Weller Dual Heat 240/325 Watt Gun
Model D-550

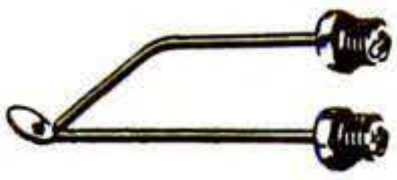
Weller Dual Heat 145/210 Watt Gun
Model D-440

ACCESSORY AND REPLACEMENT TIPS FOR WELLER GUNS



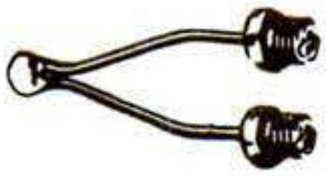
SOLDERING

For gun model 8200 —**Tip 8125N**
For gun model D-440—**Tip 7135N**
For gun model D-550—**Tip 7250N**



SMOOTHING

For gun models D-440 and 8200 —**Tip 6120**
For gun model D-550—**Tip 6140**



CUTTING

For gun models D-440 and 8200 —**Tip 6110**
For gun model D-550—**Tip 6130**

Learn how to solder properly and easily. Send 15c for this booklet.

WELLER ELECTRIC CORP., 601 STONE'S CROSSING ROAD, EASTON, PA.

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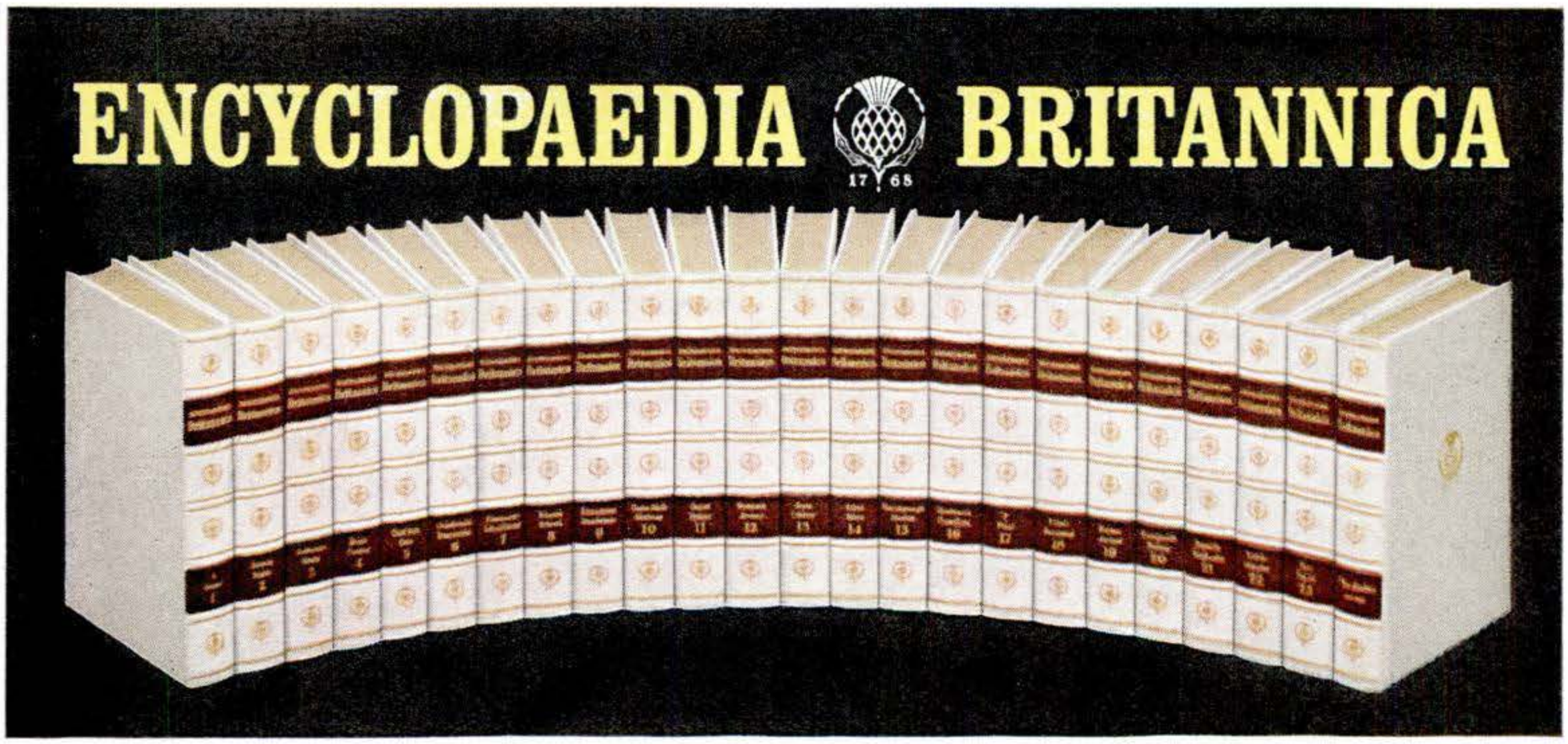

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